



GROW PROTEAS

Graham Duncan • Neville Brown • Louise Nurrish



KIRSTENBOSCH
GARDENING SERIES

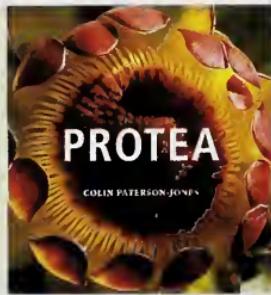


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In Memoriam
Colin Paterson-Jones
We remember Colin Paterson-Jones,
who died in January 2013,
for his outstanding photographic
contribution to many botanical
publications, particularly Proteaceae.



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GROW
PROTEAS

A Guide to the Cultivation and Propagation of South African Proteaceae

Text by Graham Duncan, Neville Brown and Louise Nurrish

Text on grafting by Robbie Thomas

Photographs by Graham Duncan unless otherwise acknowledged



Leucospermum praecox



Dedicated to Dr John Rourke

In recognition of his tremendous contribution to our knowledge of the South African members of the family Proteaceae, through his field observations and collections, his taxonomic revisions and many publications, which he has done with great enthusiasm and dedication.

Dr Rourke has had a long and successful career in taxonomic botany, which focused on his special interest in the southern African Proteaceae. He joined the staff of the Compton Herbarium at Kirstenbosch in 1966 and travelled the length and breadth of South Africa in search of Proteaceae, undertaking field studies on all known species of the genus *Protea* south of the Limpopo River. This resulted in his magnum opus *The Proteas of Southern Africa*, first published in 1980 with watercolour illustrations primarily by Fay Anderson. In 1982 he authored the magnificent elephant folio volume *Mimetes*,

illustrated in coloured pencil by Thalia Lincoln, followed by a revision of the genus *Mimetes* in 1984. In 1987 he contributed an introduction to the facsimile edition of Joseph Knight's 1809 treatise *On the cultivation of the plants belonging to the Natural Order of the Proteæ*. Amongst the many exciting plants he has described are the Golden Pagoda (*Mimetes chrysanthus*) from the Gamkaberg in the Little Karoo, the Cloud Sugarbush (*Protea nubigena*) from the KwaZulu-Natal Drakensberg and the Miracle Clivia (*Clivia mirabilis*) from the Oorlogskloof Nature Reserve at Nieuwoudtville. He also participated in studies which proved that certain proteas with cryptically concealed, yeast-scented flower heads are pollinated by nocturnal rodents.

Dr Rourke was appointed Curator of the Compton Herbarium in 1972, a position he held until his retirement in 2003.



Opposite: The Golden Pagoda (*Mimetes chrysanthus*) described by Dr Rourke in 1988.





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Above: *Leucadendron floridum*

Opposite: *Mimetes hottentoticus*





Introduction

Found almost exclusively in the Southern Hemisphere, the family Proteaceae is an ancient one whose origins date back approximately 180–200 million years to the time of Gondwana, the supercontinent whose break-up and drift resulted in smaller continents including Africa, Australia and South America, and the Islands of Madagascar, New Guinea and New Zealand, amongst others.

The Proteaceae is diverse, comprising 80 genera and more than 1700 species. Australia has by far the highest number including well known garden plants like *Banksia marginata*, *Grevillea banksii* and *Telopea speciosissima* (Waratah), and *Macadamia integrifolia* is an important commercial nut crop. The Grevillioideae, the largest of the five subfamilies, has 47 genera including *Banksia*, *Brabejum*, *Hakea*, *Grevillea*, *Macadamia* and *Telopea* and comprises 981 species mainly from Australia but also including Argentina, Chile, China, Ecuador, India, Japan, Madagascar, New Caledonia, New Guinea and Peru. The subfamily Proteoideae has 25 genera and comprises 641 species, mainly from South Africa but also including Australia, Madagascar and New Caledonia. The subfamily Persoonioideae has five genera comprising 104 species mainly from Australia but also including New Caledonia and New Zealand, the subfamily Symphionematoideae has two genera comprising three species from Australia and Tasmania and the subfamily Bellendenoideae is monotypic and endemic to Tasmania (Weston & Barker 2006). Of the 14 genera (*Aulax*, *Brabejum*, *Diastella*, *Faurea*, *Leucadendron*, *Leucospermum*, *Mimetes*, *Orothamnus*, *Paranomus*, *Protea*, *Serruria*, *Sorocephalus*, *Spatalla* and *Vexatorella*) and 352 species occurring in South Africa, most are endemic to the winter rainfall zone with the exception of *Leucadendron*.

Above: *Leucospermum patersonii*

Opposite: *Protea cynaroides* became the national flower of South Africa in 1976.

and *Leucospermum* which are also represented in summer rainfall parts, *Faurea* which is found mainly in the summer rainfall zone and also occurs in Tropical Africa and Madagascar, and *Protea* which is found throughout South Africa and also ranges widely in Tropical Africa (Rourke 1980, Rebelo 2001).

The term 'protea' is a collective one and throughout this book refers generally to all members of the Proteaceae family.

The first protea to be cultivated at the Cape was almost certainly the Wild Almond (*Brabejum stellatifolium*) which, by 1660, had been planted as a hedge to demarcate the first formal boundary of the new Dutch settlement; remnants of which still remain today at Kirstenbosch and in adjacent Bishopscourt. From the late Seventeenth Century, an upsurge in material from the extremely varied native flora of the Cape began reaching Europe for cultivation in private collections and botanic gardens, and it was the great variety of form amongst

the Cape proteas that inspired the Swedish botanist, Carl Linnaeus, to name the genus *Protea* in 1735 for Proteus, an early sea-god of Greek mythology who was capable of assuming many forms at will. The first Cape protea to flower outside its home country was *Protea repens*, the Common Sugarbush, which was brought into cultivation at Kew in 1774 and flowered there in about 1780. By the late Eighteenth Century the eminent English merchant, George Hibbert, had established the greatest living collection of proteas outside the Cape under glass at his home near London, and in 1809 the English gardener Joseph Knight's exceptional treatise *On the cultivation of the plants belonging to the natural order of Proteæ* appeared, dedicated to George Hibbert. One of Hibbert's greatest horticultural achievements was his skill in inducing *Protea holosericea* to flower, a plant which has nowhere been successfully cultivated since, and is now endangered in its natural habitat in the Kwadousberg of the Western Cape.





Above: *Grevillea banksii*



Above: *Telopea speciosissima*

Opposite: The Wild Almond (*Brabejum stellatifolium*), the first protea to be cultivated at the Cape.

Interest in the cultivation of proteas in Europe continued until about the mid-nineteenth century, but with the advent of steam pipe heating in greenhouses and its resultant increase in humidity, this new innovation spelled disaster for members of the Proteaceae which require cool, dry air. With the establishment of the National Botanic Gardens of South Africa at Kirstenbosch in 1913, the cultivation of proteas began in earnest under the enthusiastic J.W. Mathews, the first Curator. His success indirectly led to the establishment of the first retail protea nursery, owned by Kate Stanford, near Stellenbosch in South Africa. Beginning in the late 1940s, the Stellenbosch farmer Frank Batchelor pioneered the commercial protea cut flower trade in South Africa through

selection and hybridisation. During the 1950s the botanist Dr Marie Vogts began the popularisation of the cultivation of proteas through the publication of her famous book *Proteas: know them and grow them*, and at the same time, Ruth Middelmann's protea nursery made plants widely available to the public. In 1976, *Protea cynaroides*, the King Protea, became the national flower of South Africa.

South African Proteaceae is represented in all nine provinces of the country, from Cape Agulhas at its southernmost tip, to northern Limpopo. Its habitat is remarkably variable, from windswept, sandy coastal flats just above sea level (forms of *Protea cynaroides*) to inaccessible basalt cliffs 2300 m high in the KwaZulu-Natal Drakensberg (*Protea nubigena*), but it is in the unique fynbos vegetation of





Opposite: Burnt Silver Trees (*Leucadendron argenteum*) and *Amaryllis belladonna* after a fire on Lion's Head, northern Cape Peninsula.

Above: A wild fire sweeps across mountain slopes above Betty's Bay.

Below: *Protea cynaroides* re-sprouting after a fire at Gansbaai.



the south-western and southern Cape where its greatest diversity is to be found. One of the distinctive peculiarities of the Proteaceae in the Cape Floristic Region is its adaptation to fire, in which most species are killed outright and survive in seed form, but a number endure and re-sprout from persistent subterranean lignotubers, like *Leucadendron salignum* and *Protea cynaroides*.

Unfortunately with urbanisation and a variety of other threats including alien plant invasion, expanding agriculture and fruit orchards, overgrazing, poor fire management and illegal wildflower harvesting, many Proteaceae are threatened with extinction, especially those endemic to lowlands of the Cape Flats and southern Cape Peninsula, like *Leucadendron floridum* and *Serruria aemula*. The Protea Atlas Project, based at the South African National Biodiversity Institute (SANBI), had as its aim to record the geographical location of all proteas throughout southern Africa for the benefit of conservation. It resulted in the recording of many range extensions and the discovery of numerous new species, and culminated in the publication of the *Protea Atlas Manual* (Rebelo 1991). Threatened Proteaceae have been comprehensively evaluated by Rebelo *et al.* (2006) and can be accessed by means of the SANBI Threatened Species Programme (<http://redlist.sanbi.org>).

The Cape Proteaceae continues to render surprises. For example, the spectacular *Mimetes stokoei* was discovered by the naturalist T.P. Stokoe in the Kogelberg in 1922 and, after being seen in flower for the last time in September 1950, was thought to have become extinct by 1959, due mainly to over-exploitation for the cut flower market. A single seedling made a brief reappearance in 1966 but after its demise in 1969, the species was considered extinct for the second time. Following a devastating fire which

raged across the Kogelberg in December 1999, the species made a come-back after 30 years when a number of young plants were discovered two years later by the park manager, Mark Johns. They flowered for the first time in 2004, and spectacularly so in 2007 (Slingsby & Johns 2009). Since then, a concerted effort has been made by Robbie Thomas to propagate this species by grafting scions onto rootstocks of *Leucospermum conocarpodendron* and the hybrid *Leucospermum 'Veldfire'* (*L. glabrum* x *L. conocarpodendron*) and plants are now flourishing in cultivation. In 2011 another fire destroyed all the *M. stokoei* plants and seedling regeneration occurred once again, though not as well as in 1999 (Robbie Thomas, pers. comm.). Thus, a number of Proteaceae species which are strongly dependent on fire for their survival, such as *Mimetes stokoei* and the Marsh Rose *Orothamnus zeyheri*, may exist entirely in seed form within the soil until suitable conditions return for their germination.

An equally remarkable story surrounds *Leucospermum conocarpodendron*. In 2005, 40 small packets of seeds were found at The National Archives in London by Roelof van Gelder, a guest researcher from the Royal Dutch Library. They were found within files held in a red leather-bound notebook belonging to Jan Teerlink, a Dutch merchant, who had evidently collected them at the Cape in 1803 while *en route* home from Java and China aboard the Prussian ship Henriette. Midway through its journey, the ship was captured by the British Navy and all documents, including the notebook, were handed over to the High Court of Admiralty. From there the notebook found its way to the Tower of London (c. 1803-1857), then to Chancery Lane (1857-1996) and from there to the National Archives where it was uncovered during recent cataloguing. The



Above: The Marsh Rose (*Orothamnus zeyheri*) is strongly dependent upon fire for its survival.

seeds were sent to Kew's Millennium Seed Bank in Wakehurst Place where samples from each of the 32 species were sown. Seeds of three of the species germinated; the first to do so were the legume *Liparia villosa* which unfortunately did not survive, but the second species, *Leucospermum conocarpodendron* subsp. *viridum*, yielded a single seedling out of the eight seeds that were sown and had been given a smoke pre-treatment.

The plant has grown vigorously into a small shrub, 1 m high, at Wakehurst Place. Drawing a parallel between the imprisonment and survival of Princess Elizabeth (1533–1603) in the Tower of London, before she became Queen Elizabeth I of England, the plant has been afforded the cultivar name 'Princess Elizabeth' by Kirstenbosch Nursery Manager, Anthony Hitchcock. As a gift from the Royal

Botanic Gardens, Kew to Kirstenbosch for its 2013 Centenary celebrations, Dr Paul Smith, Head of the Millennium Seed Bank, arranged for cuttings from the plant to be couriered to Kirstenbosch and they are now being rooted at the Protea and fynbos nursery at Arnelia Farms on the west coast, while the Kirstenbosch Collections Nursery propagation facilities undergo refurbishment.

The importance of plant conservation through long-term seed storage cannot be emphasised strongly enough, and to this end, wild-collected seeds of many threatened South African plants, including Proteaceae, are in cold storage at the Millennium Seed Bank at Wakehurst Place as a precaution against extinction, and for possible use in re-introduction programmes into the wild.



The seed remains the property of South Africa. Already, a number of threatened proteas have been planted back into the wild from material propagated at Kirstenbosch. These include *Serruria aemula* (planted in Plattekloof Natural Heritage Site), *S. furcellata* (Bracken Nature Reserve) and 12 taxa comprising mainly threatened members (*Leucadendron laureolum*, *L. levisanus*, *L. macowanii*, *Leucospermum conocarpodendron* subsp. *viridum*, *L. hypophyllocarpodendron* subsp. *hypophyllocarpodendron*, *Mimetes hirtus*, *Protea repens*, *P. scolymocephala*, *Serruria cyanoides*, *S. foeniculacea* and *S. trilophia*) have been planted in Tokai Park in the southern Cape Peninsula. For a Proteaceae species to be successfully classified as 'restored' into the wild it has to have survived three life cycles, i.e. it must have set seed, been burnt, germinated and been pollinated three times. The Tokai Park plants are growing well but with respect to pollination and setting seed, results will not be known until the next fire.

Today, commercial protea-growing for cut flowers, bedding and pot plants is a worldwide industry with major centres in Australia, Chile, Israel, New Caledonia, New Zealand, Portugal, South Africa and the USA (California and Hawaii), amongst others. Demand for Proteaceae flora continues to grow, with an ever-increasing emphasis on hybridisation and selections, and in South Africa, many garden centres now stock proteas for a range of conditions. Commercialisation for pot plant production is the latest trend, and in Israel, for example, it has been shown

Above left: *Mimetes hirtus* has been re-introduced into the wild in Tokai Park.

Above right: *Leucospermum conocarpodendron* subsp. *viridum*. A single seed of this pincushion, collected at the Cape in 1803, germinated at the Millennium Seed Bank at Wakehurst Place, having been in storage for over two centuries.

Opposite: *Mimetes stokoei* was considered extinct in 1969 but re-appeared after a fire 30 years later.



Robbie Thomas



that flowering, potted *Leucadendron* plants can be obtained in as little as 3–5 months by rooting branched cuttings with fully initiated floral buds (Ben-Jacov *et al.* 1986).

The emphasis of this second edition of *Grow Proteas* is on conservation through cultivation and propagation of the most rewarding species and their selections within the showier Proteaceae genera found in South Africa.

While it is true that many of the rarer species included here are not yet available commercially, that position is slowly changing as an ever-increasing number are being propagated through improved cultivation and propagation techniques and made available in small quantities through specialist indigenous plant nurseries. Two notable recent introductions have been *Mimetes argenteus* and *M. splendidus*.

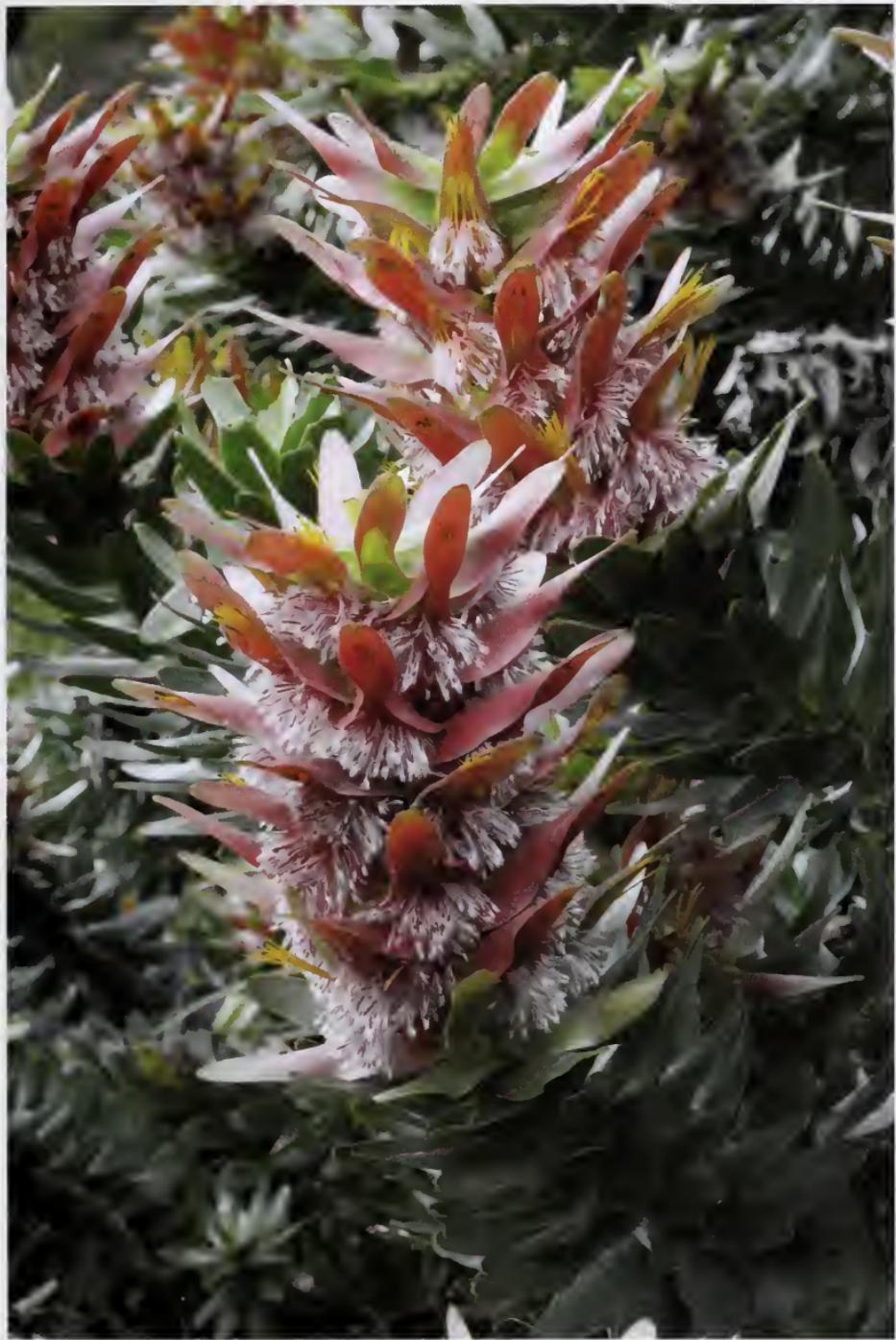
Above: *Leucadendron salignum 'Blush'*; one of many cone bushes grown commercially for its cut stems and as a bedding and container plant.

Below: Historical view of *Orothamnus zeyheri* bagged flower heads above Hermanus, October 1974.

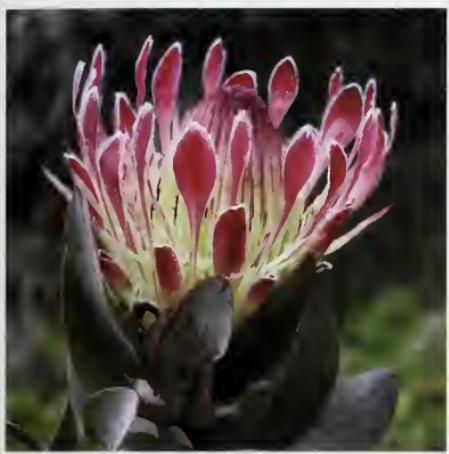
Opposite: The endangered *Mimetes splendidus* has recently been introduced into horticulture in limited numbers.



Kirstenbosch NBG







Cultivation Guidelines

(Refer to additional cultivation notes under each genus treatment on pages 70 (*Protea*), 96 (*Leucospermum*), 118 (*Leucadendron*), 135 (*Mimetes*), 147 (*Serruria*), 155 (*Aulax*), 159 (*Brabejum*), 161 (*Diastella*), 163 (*Faurea*), 167 (*Orothamnus*), 169 (*Paranomus*)).

Members of the protea family are essentially social plants, although there are some exceptions. Many of the species growing in their natural habitat occur in close proximity to one another, forming close-knit communities. The individual plants protect one another from prevailing winds and form a dense cover that prevents compaction, keeps the soil cool and reduces the rate of evaporation. In cultivation, growing Proteaceae in association with other fynbos plants such as buchus, ericas, phyllas and restios creates a pleasing effect and lengthens the life of the plants. At the outset it has to be accepted that most protea plants are relatively short-lived in cultivation and have to be replaced or re-propagated from time to time.

Proteas generally are adaptable and, with an understanding and appreciation of the basic growing requirements of these plants, one is assured of a reasonable chance of success and a great deal of pleasure. In parts of the United Kingdom and Ireland where milder winters are experienced, some proteas have been grown successfully in the open, however in most areas the winters are too cold and they have to be grown under greenhouse conditions. An excellent manual on the cultivation of proteas in greenhouses by the English gardener Joseph Knight appeared in 1809, and his advice is still relevant today (see <http://protea.worldonline.co.za/growthknight.htm>).

Above: *Protea eximia*

Opposite: *Leucospermum tottum* var. *tottum* interplanted with the everlasting groundcover *Syncarpha argyropsis*.



Climatic conditions

For optimum performance, South African protea plants require full sun. Those from the winter rainfall area require excellent air circulation and cool nights, and cannot abide high humidity in summer, whereas the summer rainfall species are more tolerant of high humidity. In their natural habitats, proteas are found growing in areas that show considerable variation in temperature. For example, a maximum of 32°C or more is not uncommon during the summer, particularly in the Sandveld and Cederberg. Temperatures are lower in the mountain ranges where the effects of prevailing winds, mists and cloud have a cooling effect. The minimum temperature in these mountainous areas may fall below 0°C, but not usually for long periods of time. Snow falls regularly on the Cape mountains during winter.

Plants belonging to the Proteaceae occur in regions where the rainfall varies from as low as 180mm to 2500mm per annum. This, however, is rather deceptive. In their natural habitat many species occur in depressions, gullies, valleys and on south-facing slopes where the plants utilise underground moisture through seepage accumulated during winter. A good example of this is the King Protea (*Protea cynaroides*) which is always found growing in areas with abundant underground seepage. When choosing a site for growing proteas in the open, ensure that you have an adequate supply of water until plants are established, a well-drained acid soil, a sunny aspect and good air circulation; proteas perform best in windy conditions.

Opposite: *Leucadendron argenteum* requires full sun and good ventilation.

Plant selection for windbreaks, screens and hedges

Leucadendron argenteum
Leucadendron coniferum
Leucadendron eucalyptifolium
Leucadendron galpinii
Leucadendron laureolum
Leucadendron 'Safari Sunset'
Leucadendron xanthoconus
Protea aurea (both subspecies)
Protea eximia
Protea lanceolata
Protea laurifolia
Protea mundii
Protea nerifolia
Protea punctata
Protea roupelliae subsp. *roupelliae*

Plant selection for coastal gardens

(Plants are tolerant of salt-laden wind)

Mimetes cucullatus
Protea burchellii
Protea compacta
Protea cynaroides (coastal ecotypes)
Protea lanceolata
Protea lepidocarpodendron
Protea obtusifolia
Protea repens
Protea susannae

Hardiness

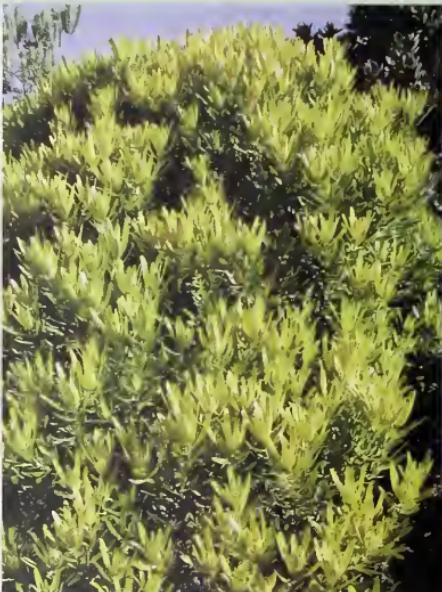
Whereas forms of certain summer rainfall species are moderately or strongly frost tolerant, such as *P. roupelliae* subsp. *roupelliae* from the Drakensberg, the winter rainfall species, especially those from the south-western Cape, are generally only tolerant of light frost (down to -2°C) for short periods, once the plants are fully established. The leaves of those which can take heavy frost (-6°C or more) are generally unaffected by frost although their flower heads may be



Above: *Protea nerifolia* forms an excellent informal hedge.

Below left: *Mimetes cucullatus* is tolerant of salt-laden wind.

Below right: *Leucadendron laureolum* is strongly hardy down to -6°C.



damaged. In susceptible areas, young plants (1–2 years old) can be covered at night with frost blankets and seedlings should generally be regarded as frost tender while young (for the first two years) and only once well established do their hardiness capabilities become evident.

Key to hardiness ratings

- 0°C**  **half hardy** (plants can withstand temperatures down to 0°C or 32°F and very light frost for short periods of a few hours)
- 2°C**  **slightly hardy** (plants can withstand temperatures down to -2°C or 28.4°F and light frost for short periods of a few hours)
- 4°C**  **moderately hardy** (plants can withstand temperatures down to -4°C or 24.8°F and moderate frost for short periods of a few hours)
- 6°C**  **strongly hardy** (plants can withstand temperatures down to -6°C or 21.2°F and heavy frost for short periods of a few hours)

Plant selection for exceptional frost hardiness

(Plants are hardy down to -6°C or more for short periods, once fully established)

- Brabejum stellatifolium*
- Leucadendron 'Jester'*
- Leucadendron laureolum*
- Leucadendron rubrum*
- Leucadendron 'Safari Sunset'*
- Protea eximia*
- Protea roupelliae* subsp. *roupelliae*
(Drakensberg ecotypes)

Key to cultivation symbols

-  recommended for garden cultivation
-  recommended for container cultivation
-  recommended as a cut flower

Key to Common Name abbreviations

(A) = Afrikaans; (NS) = North Sotho;
(V) = Venda; (X) = Xhosa; (Z) = Zulu

Soil

The vast majority of South African proteas occur in the south-western and southern Cape, hugging the coast and mountainous regions eastwards to Port Elizabeth and spreading up the west coast to south-western Namaqualand. The soils are variable, generally nutrient-poor and predominantly derived from Table Mountain Sandstone, particularly those of the high mountainous regions. Thus for cultivation, nutrient-poor soils are best, to which a mulch layer can be applied to conserve moisture, keep the soil cool and reduce weed growth.

Species of Proteaceae also grow on Bokkeveld shale, which has a high content of clay, but generally in cultivation proteas don't survive in heavy clay media, and in such conditions one needs to plant on slopes or create soil mounds into which acid compost has been thoroughly mixed; the addition of gypsum will assist in separating clay particles.

Along the coastal regions, proteas are often found growing in pure sand and generally the pH values of the soils they favour are on the acid side. Most species need a pH of 5–7 or less, although there are instances of

proteas growing in areas with alkaline soils with pH values as high as 8.4. One of the most important requirements for the successful cultivation of proteas is a well-drained soil that is also well aerated. Under natural conditions proteas are mostly found growing on mountain slopes that provide just such well-drained sites. A limited number of proteas will tolerate clay soils but many will grow well in good garden loam. Some proteas perform well in semi-arid conditions (see page 21) and most are more or less waterwise once fully established.

Plant selection for clay soils

Leucadendron argenteum
Leucadendron laureolum
Leucadendron salignum 'Red Devil'
Leucadendron sessile
Leucadendron stelligerum
Leucospermum conospermum subsp.
conospermum
Protea burchellii (clay ecotypes)
Protea coronata

Protea laurifolia
Protea nerifolia
Protea obtusifolia
Protea 'Pink Ice'
Protea pudens
Protea repens (clay ecotypes)
Protea scolymocephala (clay ecotypes)

Plant selection for slightly alkaline soils

Leucadendron coniferum
Leucadendron laureolum (limestone
ecotypes)
Leucospermum patersonii
Protea eximia
Protea lanceolata
Protea laurifolia
Protea mundii
Protea nerifolia
Protea obtusifolia
Protea pudens
Protea repens (limestone ecotypes)
Protea scolymocephala
Protea susannae



Planting

In winter rainfall areas, proteas are best planted out into the garden and permanent containers in autumn, in April and May, once cool, moist weather has definitely set in. Before planting, the chosen site should be cleared of all growth, and individual holes, 250 mm deep and square, prepared for each plant. The recommended planting distance is 0.65 m for species that attain a maximum height of 2 m, and those exceeding 2 m are planted at a distance of 1 m. Smaller species, such as *Diastella* and *Serruria* can be planted 0.5 m apart. After removal from a nursery bag or pot, be sure to place the plant at the same level as it was in the container, and disturb

the roots as little as possible. Firm the soil around each plant and water well. In summer rainfall areas, proteas are best planted out immediately after the frost period has passed, in August and September, while the air is still cool. Proteas like to be planted in groups, which provide mutual support in strong wind, keep the soil cool and give a better display.

Watering

Once fully established in garden beds with loam soils, most proteas are drought tolerant, but during their first two summers they will need a thorough soaking twice or even three times per week depending on prevailing weather conditions. Thereafter moisture can be reduced as they become more established. When planted in very sandy soils, watering daily or every second day may be necessary. During the first two years the young plants have to be watered regularly. By mulching the area with well-rotted pine needles, acid compost or acid wood chips to a depth of 50 mm, weed development is kept to a minimum. Other advantages are that the soil is kept moist, soil temperatures are kept down and mulching is a form of feeding. Plant roots should not be subjected to sudden changes in temperature as this may encourage fungal infection. Fungal infection may result in plants kept too wet at night over long periods, especially amongst species of *Serruria*, thus watering is best done in the early mornings as at this time, water temperature is more or less the same as that of the soil. When grown in containers, plants need a good soak every second day or even daily in very hot weather.

Species from marshy habitats like *Leucadendron macowanii* and *Mimetes hirtus* like high soil moisture content but still need good drainage to allow adequate aeration of the roots.

Below: *Leucadendron macowanii* likes moist, well drained acid soil.

Opposite left: *Protea nerifolia* tolerates clay soils.

Opposite right: *Protea obtusifolia* tolerates slightly alkaline soils.





Plant selection for semi-arid conditions

(Plants are drought tolerant once fully established)

Leucadendron galpinii
Leucadendron nobile
Leucadendron rubrum
Leucadendron salignum
Leucadendron xanthoconus
Leucospermum cordifolium
Leucospermum erubescens
Leucospermum formosum
Leucospermum grandiflorum
Leucospermum lineare
Leucospermum reflexum
Protea aristata
Protea burchellii
Protea eximia
Protea lanceolata
Protea laurifolia
Protea mundii
Protea punctata
Protea repens
Protea scolymocephala
Serruria fucifolia

Plant selection for perennially moist conditions

(Plants will also perform well in moderately moist soil)

Leucadendron floridum
Leucadendron laxum
Leucadendron macowanii
Mimetes hirtus
Protea cynaroides

Mulching

During the hot summer months in winter rainfall areas, the soil surface dries out rapidly and becomes too hot, especially in very sandy soils, thus soil mulching is necessary to retain moisture, keep the roots cool and reduce weed growth. Surface mulches can comprise any decayed organic material such as that made from leaves, chipped wood or bark, or straw.

Below: Proteaceae, such as *Leucospermum 'Thomson's Gift'*, benefits from soil mulching.

Opposite: *Leucospermum erubescens* is drought tolerant once fully established.



Acid compost or decayed pine needles form an excellent mulch, but mushroom compost is detrimental as it contains high levels of phosphorus fertiliser. Soil temperature around the plants can also be reduced by placing stones or rocks around the base of the trunks. Proteaceae surface roots are very sensitive to disturbance, thus in suppressing weed growth, mulching reduces the need to pull out weeds by hand. To avoid root disturbance, do not pull out large weeds by hand, but cut them off just below soil level with sharp secateurs.

Feeding

Proteas have very low nutrient requirements and the application of most fertilisers is detrimental. In most gardens with loam soils, no supplementary feeding is really necessary, although the application of organic fertilisers derived from seaweed and fish will encourage the development of the sensitive proteoid roots. In very sandy soils, and in containerised plants, a mulch of acid compost and organic

slow-release fertiliser, applied in granular form in late winter and mid-summer at half the recommended rate, is all that is required. Most artificial fertilisers must be avoided, especially those containing phosphorous (P) as they are absorbed in excessive quantity by the proteoid roots, resulting in collapse and death of plants. Manure, mushroom compost and bone meal must not be used at all.

A highly recommended organic fertiliser for proteas is 5:1:5 (16), manufactured by Talbourne, in which nutrients are released slowly. It contains all the macro-nutrients needed, but more importantly, the micro-nutrients as well, but it has to be applied sparingly, failing which excessively lush growth is produced. The organic fertilisers Kelpak (derived from seaweed) and Seagro (a fish emulsion), applied at half the recommended rate, are recommended for establishing newly rooted cuttings and seedlings.



Pruning

Light pruning is essential to maintain the desired shape and extend the life of protea plants. It should begin at the seedling/cutting stage and continue throughout the plant's life. Two types of pruning are used: thinning-out and heading-back. Thinning-out is the removal of excess, diseased or dead branches at their base. Heading-back is the removal of branches (especially those which have flowered) at any point above the base, to encourage re-sprouting. In heading-back, branches of most species must always be cut at a point above where healthy leaves occur, in order for strong new growth to develop from the leaf axils. Exceptions are species with lignotubers like *Mimetes cucullatus* and *Protea cynaroides*, in which branches are severely headed-back to the base of the plant to encourage re-sprouting. To encourage bushy growth, young plants should be tip-pruned six months to one year after planting, and from then onwards, every one to two years after flowering.

In mature protea plants, all old heads should be removed and half the stems can be headed-back. This is best done directly after the flowering period and just before active vegetative growth begins, which for most species is from spring to late summer. Always use sharp secateurs to prevent excessive damage to the cut areas.

Seedlings of slow-growing, well-branched species like *Protea grandiceps*, *P. magnifica* and most *Leucadendron* and *Leucospermum* species can be thinned-out to the strongest 3–5 shoots after one year, then headed-back in the latter two genera, but not in most species of *Protea*. In poorly branched species like *Protea compacta* and *Serruria florida*, heading-back in seedlings is done in the first year during the active growing season. *Protea* plants grown from cuttings producing a single growth shoot should be headed-back by removing the tip once it has reached 15–20 cm long, while cuttings producing multiple growth shoots should be left alone.

In *Leucadendron* and *Leucospermum*, plants grown from cuttings are best thinned-out in early spring to about five strong shoots, then headed-back. If flowers develop on plants grown from cuttings shortly after planting, they should be removed immediately to allow vegetative growth to take place, except in commercial pot plant production. Young bushes are best tip-pruned in early spring and late summer, whereas mature plants should be pruned immediately after flowering, leaving 10–15 cm of leafy stem remaining below the cut. It is important to note that pruning bare stems (below the leaf-producing area) will result in the death of that stem, except in species with lignotubers like *Mimetes cucullatus*, *Protea cynaroides* and *P. speciosa*. In the genus *Protea*, non-flowering stems should not be pruned as these will flower the following season.

Opposite left: *Mimetes cucullatus* branches can be pruned back hard to encourage new shoots.

Opposite right: Poorly branched species like *Serruria florida* require pruning at seedling stage.

Container cultivation

With the modern trend towards smaller outdoor living spaces and courtyard and patio gardening, the cultivation of proteas in containers is gaining popularity. With adequate care, container-grown proteas can provide much pleasure and when in flower, certain smaller species and dwarf cultivars can be brought indoors for a few days at a time. Those recommended for containers are low-growing species like *Leucospermum prostratum* and *Serruria villosa* and those that re-sprout from lignotubers like *Leucadendron salignum*, *Mimetes cucullatus* and *Protea cynaroides* (see key to cultivation symbols on page 17 and relevant symbol adjacent to each species from page 72 onwards).

With containerised proteas, attention has to be paid to regular watering, which may have to be applied daily in very hot weather. Heavy mulching, re-potting every second year and the application of a slow-release fertiliser is recommended. Placement of containers has to be carefully considered such that they will not overheat on very hot days and it is best for them to receive full morning sun and afternoon shade in summer.

Greenhouse cultivation

In cold climates, successful cultivation of most proteas under greenhouse conditions requires the simulation of a Mediterranean-type climate. This means that for winter conditions, temperatures should preferably not drop below 0°C; average minimum winter temperatures should be 5°C–8°C and average maximum winter temperatures 15°C–20°C. For summer conditions minimum temperatures of 12°C–15°C and maxima of 25°C–30°C are ideal. Humidity should be kept low and there should be adequate movement of cool air. Hot and



Above: *Leucadendron salignum* 'Red Button'

Below: *Paranomus sceptrum-gustavianus*



steamy conditions should be avoided at all costs. A practical approach is to grow proteas in containers and place them out of doors

during the warmer part of the year, returning them to the greenhouse for protection during the winter.



Above: *Serruria villosa*

Below: *Leucospermum prostratum*





Attracting wildlife to the garden

Most South African proteas are pollinated by insects, including various bees like the Honeybee (*Apis mellifera*), scarab beetles like the large Green Protea Beetle (*Trichostetha fascicularis*), the Tiger Chafer (*Atrichelaphinis tigrina*) and numerous smaller monkey beetles, including the Glittering Monkey Beetle (*Anisonyx ditus*) that feeds on their pollen and nectar. The flower heads of some species, like *Protea repens*, are so sticky that insects get trapped on, or within them.

Proteas with fruity scents like *P. coronata* are most attractive to beetles. Those with plentiful nectar attract nectar-feeding birds like the Cape Sugarbird (*Promerops cafer*), Orange-breasted Sunbird (*Anthobaphes violacea*) and Southern Double-collared Sunbird (*Cinnyris chalybeus*), bringing a new dimension of colour and interest to the garden.

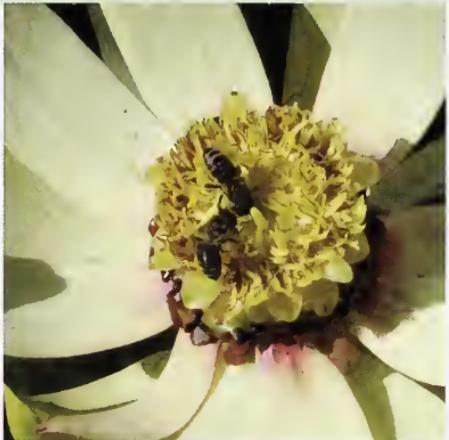
Plant selection for attracting birds and insects

- Leucadendron argenteum* (bees)
- Leucadendron sessile* (bees, beetles)
- Leucadendron tinctum* (bees)
- Leucospermum bolusii* (bees, butterflies, moths, wasps)
- Leucospermum conocarpodendron* (birds)
- Leucospermum cordifolium* (bees, birds)
- Leucospermum reflexum* (birds)
- Leucospermum tottum* (bees, birds)
- Mimetes chrysanthus* (bees, birds, butterflies)
- Mimetes cucullatus* (birds)
- Protea compacta* (birds)
- Protea cynaroides* (bees, beetles, birds)
- Protea lanceolata* (bees, beetles)
- Protea mundii* (birds)
- Protea nerifolia* (birds)
- Protea punctata* (bees, birds, butterflies)
- Protea repens* (bees, birds)
- Protea roupelliae* subsp. *roupelliae* (birds, butterflies)
- Protea susannae* (bees, birds)
- Serruria aemula* (bees, beetles)
- Serruria rosea* (bees)

Below left: Southern Double-collared Sunbird on *Leucospermum oleifolium*.

Below right: Honeybees are strongly attracted to *Leucadendron tinctum*.

Opposite: *Mimetes chrysanthus* is attractive to insects including the *Acraea horta* butterfly.

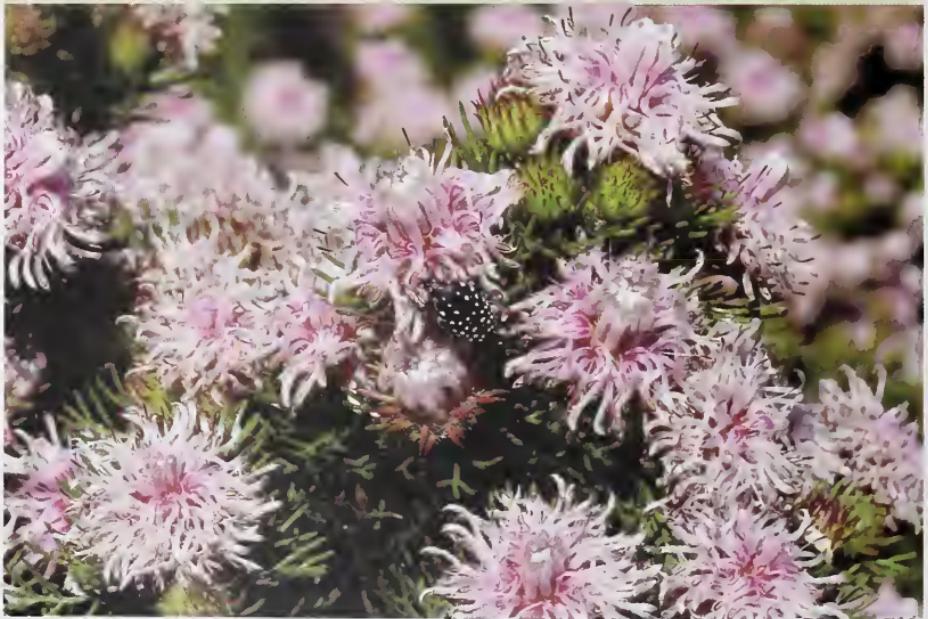




Above: A Green Protea Beetle feeding on pollen of *Protea cynaroides*.

Below: A monkey beetle feeding on pollen of *Serruria aemula*.

Opposite: An Orange-breasted Sunbird on *Mimetes cucullatus*.









Propagation Guidelines

(Refer to additional propagation notes under each genus treatment on pages 71 (*Protea*), 96 (*Leucospermum*), 118 (*Leucadendron*), 135 (*Mimetes*), 147 (*Serruria*), 155 (*Aulax*), 159 (*Brabejum*), 161 (*Diastella*), 163 (*Faurea*), 167 (*Orothamnus*), 169 (*Paranomus*)).

Seed

There are two distinct types of seeds in the South African Proteaceae. In the first group the seeds are rounded, relatively hard and nut-like. Under natural conditions these seeds are shed when mature, collected by ants and carried underground, and end up being stored in the soil. In the second group the seeds are winged or hairy, often feathery and relatively soft. They belong to the serotinous species (in which the mature seeds are held in old seed heads on living plants) such as *Aulax*, *Protea* and most *Leucadendron* species. Nut-like and serotinous seeds show different germination syndromes or patterns.

Proteaceae with nut-like seeds (e.g. *Leucospermum*)

In nut-like seeds the first indication of germination is shown by a crack in the brittle seed coat, caused by the expansion of the cotyledons (first leaves). The young root then emerges through the crack. Under natural conditions, these seeds germinate en masse during the first winter after a fire. Seed dormancy is broken when the seeds are subjected to moderately low temperature. This low temperature requirement is not a stratification requirement but a natural mechanism to promote germination during the favourable cool, moist Western Cape winter period. Fluctuating day and

Above: Nut-like seeds of *Leucospermum reflexum*.

Opposite: Old, burnt seed heads and serotinous hairy seeds of *Protea repens*.

night temperatures are also required for maximum germination. For example, a night temperature of 4°C–10°C followed by a day temperature of 20°C–24°C will give optimum germination.

The hard seed coats of the nut-like seeds tend to restrict the supply of oxygen to the seed embryo and this slows down germination.

Leucospermum seeds also have a relatively soft, gelatinous outer seed coat, which cuts down the oxygen supply to the embryo. This coat should be removed before sowing. This can be done by soaking seeds in 1% H₂O₂ or water for 24 hours and then rubbing them between the fingers to remove the softened outer layer (Hydrogen peroxide solution can be obtained from your local pharmacy). In some species of *Leucadendron*, germination can be improved by mechanically scarifying the seeds lightly with sandpaper. This treatment improves oxygen supply to the embryo.

In some species of *Leucadendron*, smoke treatment improves germination significantly. A smoke treatment combined with a scarification treatment gives even better germination results. Some growers combine H₂O₂ treatment with commercial smoke primer paper by washing each smoke primer paper with 50 ml 1% H₂O₂ and soaking seeds in this solution for 24 hours.



Seeds lose viability with age. If seeds are of uncertain age or viability, germination can be stimulated to some extent by pre-soaking seeds in a solution containing germination stimulating substances such as gibberellin GA₃ or GA₄ and GA₇ or ethrel. (These are available commercially from suppliers of scientific and agricultural chemicals, and are included in some brands of smoke papers). Seeds should also be given a light dusting with a systemic fungicide containing metalaxyl (e.g. Apron) to prevent pre- and post-emergence infection.

Serotinous Proteaceae (e.g. *Protea*)

In serotinous species the much softer seed coat does not crack but splits as the young root emerges. Serotiny is an adaptive response to fires that occur in regular cycles of four to 40 years in fynbos vegetation. Fires occur in the late summer or autumn and mature seeds are held in the living canopy until it is burnt. When the seed heads are burnt or dried by fire they open and the seeds are shed. Seeds have a low temperature requirement for germination. They require temperatures of between 1°C–11°C to synchronize germination with the first wet winter season following dispersal.

Seeds are very sensitive to excess water and it is essential that they be sown in a well-aerated, well-drained, sandy medium in order to avoid waterlogging. Another alternative is



to sow seeds between wet hessian sacking material and to plant seedlings out when the young roots emerge. Seeds should be given a light dusting with a systemic fungicide containing the active ingredient metalaxyl (e.g. Apron) to prevent pre- and post-emergence seedling infection.

In serotinous species it is often the case that most seeds within the seed head are infertile, thus it is very important to select only plump, fertile seeds for sowing (see image on page 34).

Right: Mass germination of *Leucadendron* seeds after a wild fire.

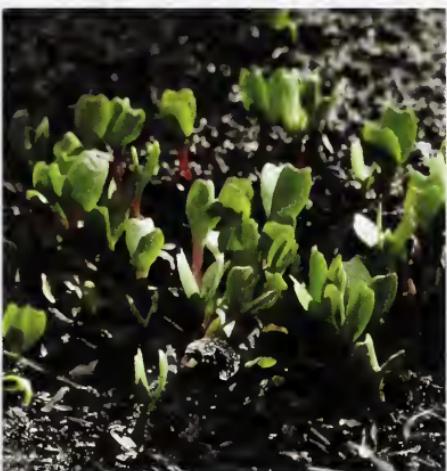
Below: Philip Botha applying smoke treatment to seeds within a polythene tent.

Opposite left: Serotinous hairy seeds of *Protea cynaroides*.

Opposite right: Nut-like seeds of *Mimetes argenteus*.

Smoke treatment

Very promising results have been obtained, showing significantly improved seed germination in many species of Proteaceae and other fynbos-occurring families, including Bruniaceae, Ericaceae, Restionaceae and Rutaceae, following treatment with smoke (Brown & Botha 2004). The seeds of these species are adapted to germinate in





Above: *Leucadendron argenteum* seed germination: smoke-treated (left), untreated (right).

Below left: Protea seed head with hairy fruits removed.

Below right: A-B, infertile Protea seed; C-D, fertile Protea seed.

Opposite: Smoke-impregnated paper discs.



response to one or more cues provided by fire, including a chemical cue in smoke, a compound which was identified by Australian and South African researchers in 2004, now known as karrikinolide 1 or KAR1.

In the plant nursery, the procedure for smoking seed is a relatively simple one. Seed is sown in conventional plastic trays and covered with a thin layer of sowing medium or finely milled bark. The trays are placed in a polythene tent and smoke is pumped into the tent by means of a plastic pipe from a large metal drum. The smoke is generated in the drum by burning a mixture of dry and green fynbos leaf and stem material. The trays are left in the smoke for 1–2 hours. At the end of this period the trays are removed and the seeds carefully watered with a watering can to wash the smoke deposit into the soil. The seed trays are then placed under cover in a shadehouse until the seeds have germinated. Seeds of many fynbos species require fluctuating day/night temperatures for germination (e.g. 20°C day/10°C night). This is a germination cue related to the post-fire environment in the natural habitat, which has a Mediterranean-type climate, with summer drought and winter rain. Removal of the vegetation cover by fire in the late summer or early autumn results in more extreme day and night temperatures at a time when the first rains are likely to begin. The best time to sow and smoke-treat fynbos seeds is thus in the late summer and early autumn (March to May in the Southern Hemisphere).

Smoke in a packet

In addition to plant-derived smoke itself, aqueous extracts of smoke also break seed dormancy and give the same dramatic improvement in seed germination in many species which have previously been difficult or impossible to germinate in the nursery. In order to make smoke technology available to

a wider spectrum of horticulturists, botanists and gardening enthusiasts, Kirstenbosch researchers developed a seed primer incorporating aqueous smoke extracts. Absorbent paper discs are impregnated with aqueous smoke solution. The discs are then dried and packed into polythene packets ('Smoke in a packet'). The smoke seed primer can be used by gardeners to break dormancy in seeds and thus germination can be improved without having to light a fire. In order to activate the primer, water is added to the paper and seeds are soaked in the solution for 24 hours. Several other smoke seed primers are now also available commercially.



Seeds are best sown in autumn, in trays or in the open ground in mild areas. Seed trays should be well prepared, with plenty of drainage holes covered with a layer of roughage to prevent blockage. It is very important that the soil mixture be well drained. A suggested sowing mixture is 8 parts finely milled pine bark and 3 parts coarse sand. An ideal pH is 4.5–5.5 and lime should be added if the mixture is too acid. The positioning of trays in the greenhouse or in the open is important. A sunny situation with good air circulation helps a great deal

in preventing the seeds from becoming waterlogged and also helps minimise fungal infection. Seeds should be sown evenly, then firmed down and covered with dry sand and watered thoroughly, using a fine rose.

Apply a further layer of sand to cover any exposed seed. A suitable depth for sowing is one and a half times the size of the seed.



The optimum temperatures for germination are night temperatures of 5°C–10°C alternating with day temperatures of 15°C–20°C. The germination period varies from 3 weeks to 3 months, depending on the species. The cotyledons are the first to appear, followed by the true leaves. At this stage the young seedlings are ready for pricking out into individual containers like plastic bags, 500 ml in size, or into compartmentalised trays. A soil mixture similar to that prepared for the seed trays, is an ideal growing medium.

After seedlings have been pricked out, they should be watered thoroughly and then placed in full sun. If conditions are particularly hot and dry, a period of hardening-off under light shade cloth may be required. Within 6

months the young plants of most species will have grown to a height of about 200 mm. The roots will show signs of growth through the bottom of the containers and the plants will therefore be ready to be planted out into the open ground or into permanent containers.

Vegetative propagation

Preparation and rooting of cuttings

Proteas can also be propagated vegetatively by means of cuttings. All hybrid cultivars are propagated in this way in order to maintain the unique characteristics of each cultivar. The most suitable cuttings are firm shoots that have just completed their growth period. Stock plants should be disease-free and not yet flowering. Erect terminal or upright-growing lateral shoots (200 to 250mm long) are preferable to horizontal side-shoots. Leaves on the basal third of the cutting should be stripped off and it is necessary to ensure that some leaves with buds remain, and that the cutting has been cut just above a potential sprouting bud. The best time to take cuttings is from November to the end of April (early summer to mid autumn) and cuttings need to be well rooted and ready for planting out before August (early spring).

The base of each cutting is dipped in a solution of rooting hormone for 5–10 seconds. Indolebutyric acid (IBA) powder at 4 g/l, dissolved in 50% ethyl alcohol, can be used for this purpose. Commercially available rooting agents, such as Seradix 2 powder or the liquid 'Dip and Grow' can also be used.

Cuttings should be rooted in multi-trays; these require minimal rooting medium and optimize heating from below and potential rooting. The rooting medium that gives the best results is a well-aerated mixture consisting of equal quantities of peat or milled pine bark and polystyrene beads. A mixture of equal

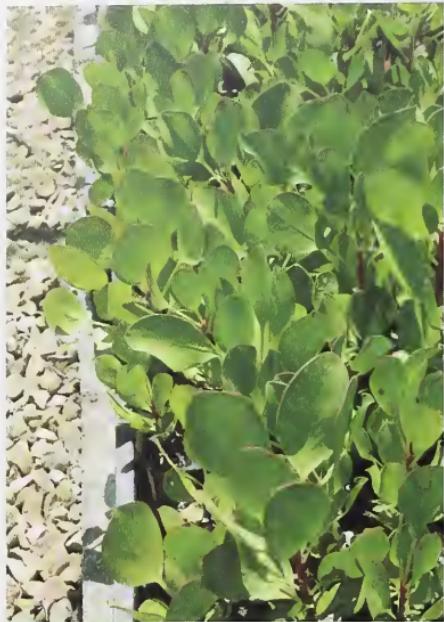


Above: *Protea cynaroides* seedlings growing in open beds.

Below: *Mimetes fimbriifolius* cuttings being rooted in multi-trays.

Opposite: Protea collection specialist Welcome Mange potting-up rooted *Serruria* cuttings into a well drained acid medium.





Above: Seedlings of *Protea cynaroides* (left) and cuttings of *Mimetes hirtus* (right) ready for planting out.

Below: *Orothamnus zeyheri* seeds germinate with difficulty and seedlings succumb rapidly to fungal infection. Grafting is the recommended propagation method.



quantities of peat or milled pine bark and coarse sand is also satisfactory. Rooting is done under standard mist-bed conditions, with bottom heat (22°C–25°C) provided. Free air circulation around the containers is necessary to minimise harmful fungal growth.

A regular spraying programme using a general fungicide may be necessary to control fungi. Any infected or wilted cuttings should be removed and destroyed. Rooting time varies from 8–16 weeks.

Rooted cuttings should be hardened-off under 50% shade cloth for 3–4 weeks before being placed in full sunlight. Cuttings rooted in multi-trays should first be established in bags or pots before being planted out.

Grafting

Text and photographs by Robbie Thomas

Line drawings by Vicki Thomas

Some Proteaceae are narrow endemics and grow poorly out of their natural environment. This applies to most of the *Mimetes* species. A weak plant is particularly vulnerable to stress (e.g. lack of water, inappropriate soil) thus when grafting it is a natural step to utilise robust hybrids, that flourish under varying conditions, as the rootstock of choice. In the wild, the Marsh Rose (*Orothamnus zeyheri*) only grows on south-facing marshy seeps at high altitude with summer cloud, yet when grafted onto the robust *Leucospermum conocarpodendron* or the *Leucospermum* hybrid 'Veldfire' (*L. glabrum* x *L. conocarpodendron*) it flourishes near sea level, facing north. Similarly, *Protea nana* becomes more floriferous when grafted onto the *Protea* hybrid 'Pink Ice' (*P. compacta* x *P. susannae*). In addition, hybrids are bred for their resistance to various pathogens.

Grafting is useful for conservation. For instance, *Mimetes stokoei* was considered

extinct for 30 years until dormant seeds germinated after a fire in the Kogelberg. When the new population started to decline after a few years, a decision was made to create an *ex situ* grafted population, which is now flourishing. The resultant seeds will be lodged in a seed bank and grafted plants could be used to establish separate colonies in the wild.

The grafting techniques described here for *Protea*, *Leucospermum* and *Leucadendron* can only be used for grafting onto rootstock within the same genus. *Mimetes* can be grafted onto rootstock of the same genus as well as cross-genus grafting onto *Leucospermum* rootstock, which is more difficult, and for this reason *Mimetes* grafting will primarily be described. New grafters should perhaps first experiment with grafting within a genus.

There are a number of factors that can influence success rate, all interlinked, so that any inattention in one area could have a knock-on effect. Hence a conservative approach is preferred, and inattention to detail can cost one dearly.

Rootstock considerations

Rootstock material has to be established well before grafting time and having the correct, vigorous rootstock with suitable stem diameters in relation to the scion, and in suitable quantity, is time-consuming and requires planning and manipulation. Purchasing material from retail or wholesale nurseries is unsuitable and it is best to generate one's own rootstock, tuned to the specific needs of grafting, i.e. a rootstock of one or perhaps two stems of about 12 cm long. The healthier the rootstock, the better the success rate will be. In addition, the stem of the rootstock onto which the scion is to be grafted should be as close as possible in age to that of the scion. A year older is passable, but older stems reduce the success rate. Often

there is an opportunity to graft multiple scions onto a rootstock with two or more stems; the closest match will callus first and intercept nutrients to the detriment of the other scions.

The choice of rootstock can be any *Leucospermum* that is the most readily available, as all seem to be compatible with *Mimetes*. As commercially available hybrids have been bred for vigour, disease resistance and ease of taking cuttings, they naturally are first choice. *L. conocarpodendron* seedlings are highly recommended, though a problem here is that the time taken from germination until use as a rootstock can be much longer than that taken by a hybrid cutting. Cuttings are generally of a thicker diameter and are useful in matching scion/rootstock diameters. The *Leucospermum* hybrid 'Veldfire' is the number one choice. Its cuttings root easily, its stems are longer and the intervals between the leaves are greater than those of *Leucospermum* seedlings. *L. conocarpodendron* has a very low mortality rate, however if rind grafting is to be used it should be noted that its rind

is relatively thick and does not peel easily, whereas the *Leucospermum* hybrid 'Veldfire' has a thinner rind and is easier to source as rootstock.

The diameter of the scion in relation to that of the rootstock diameter is only important if a single grafting technique is used. If they both have the same size cambium (large or small) then the wedge graft technique can be used (see wedge grafting techniques on page 46). If the scion is smaller than the rootstock, then the rind graft should be used. There will always be differences in cambium diameters between stock and scion and the grafting techniques should be varied according to the diameters of material on the workbench.

Generally the diameters of *Mimetes arboreus*, *M. argenteus*, *M. fimbriifolius*, *M. hottentoticus*, *M. saxatilis* and *M. stokoei* scions can be termed 'thick', needing a wedge graft.

Below: *Protea nana* rind-grafted onto *Protea* 'Pink Ice' at Arnelia Protea Farms.



M. cucullatus and *M. splendidus* have 'medium' diameters, with fewer thicker stems and thus need a wedge graft, while their thinner stems need a rind graft or a variation of it. *M. capitulatus*, *M. chrysanthus*, *M. hirtus* and *M. pauciflorus* generally have 'thin' diameters and need a rind graft, although occasionally they may have 'medium' diameters. It is relatively easy to match *Leucospermum* and *Leucadendron* scion/rootstock sizes but some of the smaller proteas such as *P. acuminata*, *P. nana* and *P. pityphylla* are thin compared to the stock diameters, requiring the rind graft technique.

Rootstocks can be developed from cuttings or seed, however obtaining seedling stems ready to accept a graft takes longer than cuttings do and quite often are too thin even in the second year. In comparison, a cutting can be grafted onto as soon as adequate roots have formed, and in addition the diameter of the stem of the cutting will be more predictable.

The longer stems available from *Leucospermum 'Veldfire'*, *L. erubescens* and *L. glabrum* for taking cuttings have the advantage that two cuttings can be made, a short one with 2–4 leaves retained, and a longer one that includes the tip. Often two long cuttings can be made that have 8–10 leaves retained.

The short ones with only 2–4 leaves retained can be established so that the resultant primary stem can be used later, while the longer cutting with 8 or more leaves can be used for grafting as soon as the roots have developed sufficiently. This can take place within a few months and even before it is potted-up, though the effect of the grafting 'shock' can sometimes be too great, especially during the warmer months. The rooting mix may be lacking in nutrients, so 'fertigation' may

be necessary during the post-graft recovery period, after the graft callus has established.

The fragile roots of the new rootstock can easily be damaged during the grafting process. A grow bag containing the new rootstock is placed into an appropriate sized plastic bottle with the bottom cut out of it. The lid is fixed onto the wood and the screw thread of the lid allows for twisting for easier positioning, without touching the grow bag, and a G-clamp secures it to the work bench (see photo on page 46).

If the graft fails, the scion can be pruned off, allowing a second graft to be performed onto the stub, though a period of recovery should be allowed. If too short, a new primary stem can be allowed to develop from the rootstock.

The bark of a long rooted cutting is more workable, i.e. the bark peels off the cambium more easily for rind grafts, but less so in a new immature primary shoot, sometimes damaging the cambium layer.

A newly rooted cutting may not have a root system well developed enough for it to supply the scion with sufficient water over the graft interface to replenish loss through transpiration. This can become more significant if the rooted cutting has been used for grafting in hot weather. Trimming leaves of a *Mimetes* scion by a percentage to reduce transpiration runs a high risk of the leaves dying back progressively, and affecting the stem as well. In warmer months, new grafts are best kept in a bright area of 100% shade for the first week although the hybrid 'Veldfire' rootstock does not react well to continuous 100% shade after grafting. Fogging and air conditioning should be considered.

Scion considerations

Material taken from the wild can vary considerably. Stems from older or senescent plants should be avoided, while those of young plants 2–4 years after a fire are best. Even better are plants that have been carefully nurtured, and here creative pruning and fertilisation give the scion a running start, yielding longer stems and a better 'take'. Stem pruning will often yield six new shoots and if all are allowed to develop, all will be short. It is preferable to nip out most and allow two or three to attain a better length that will yield healthier scions per stem. An indication that the silver leaves of *Mimetes* are not healthy is when they develop slightly darker patches, in which case the stem should be discarded.

Stems from the current year's growth yield the best results; however if taken too soon, i.e. when not mature enough, they will dehydrate and flop. It is often necessary to trim off the upper, softer part, though better to wait until the whole stem is mature enough.

Tools

All cutting tools should be razor sharp. It is best to have at least two of each tool ready per grafting session and sharpen them between sessions. Secateurs should be disassembled, wiped clean of oil, and sharp. Their blades should be sharpened on one side only and the blade and anvil should pass each other with no gap between. A blunt or misaligned tool will cause extra cell destruction at the interface that the plant will have to accommodate. This destruction of cells when cutting is unavoidable but should be minimized.

Blade shapes are important. The one used for cutting the vertical slit into the rootstock should taper evenly and equally from the back of the blade to the cutting edge, without any final sudden honing taper. This allows for less 'wandering' of the blade inside the vertical cut and there is less crushing of cells. Thinner scions and stems are more vulnerable to wandering blades and an unpractised hand

Below: Grafting Tools, **A** = special knife made from an old secateur blade; **B** = U-shaped chisels (4 mm, 7 mm, 10 mm) used to scoop out xylem of the scion during rind grafting; **C** = small snipping scissors used to trim off excess leaves; **D** = kitchen pairing knife used to make the vertical cut; **E** = grafting knife; **F** = grafting knife. Tools have to be kept sterilised at all times and suspended when not in use.



will wander more within thin stems, especially if the blade is the wrong shape, or blunt. A kitchen paring knife (see knife D with black handle in the photo opposite) is ideal as the longer blade allows for a number of cuts to be made without re-sterilising.

The blade shape for the wedge-cut on the scion is the same shape as the secateurs blade, flat on one side, with the sharpened surface on the other. A special knife can be made by welding an old secateur blade onto a piece of flat iron and grinding off most of the back of the blade to form a crescent shape; this allows the blade to be pulled back further without being restricted by the first leaves of the scion (see knife A in the photo opposite). It also allows for a better slashing cut when the blade is pushed and wrist-swivelled (to the left or right) at the same time. The shape produced by sharpening in such a manner (flat on one side) will always direct the blade into a deeper cut with minimal wandering. The flat face of the blade is the important one, not the sloping face, and when sharpening it, one should try to attain a polished surface on the flat side which drags over the face of the wedge. If it is rough it will leave a rough 'finish' on the wedge face. Blades for left-hand secateurs are available from specialist suppliers.

The U-shaped chisels (see photo B opposite) are wood-carver's chisels and three sizes (4 mm, 7 mm and 10 mm) are recommended. Small snipping scissors (see photo C opposite), as used in the fruit industry, are ideal to trim off excess leaves although stripping off leaves by hand is much quicker, but wounds the stem more in some species, depending on its stage of development.

An oilstone with a rough and a smooth surface should be used for sharpening, with a further extra fine oilstone for finishing and

polishing. A rough face on the blade of the knife will tear more cells on the wound face and the extra fine oilstone will smooth the face of the blade. An even finer water stone that polishes the face of the blade can be used, leaving a mirror finish that drags even less inside the cut. Water stones of three different grades can be used, a diamond-faced sharpener is an option, but its price is a factor.

Hygiene

Strict attention has to be paid to sterilisation of all tools. Methylated spirits, formalin, alcohol or household bleach can be used. The tools can either be dipped or wiped with a soaking cloth, but preferably wipe them dry with tissue paper rather than let them evaporate as a residue may be left behind. Burning-off the alcohol heats the blade, which therefore cannot be used for a time, though this is not an issue if several sets of tools are being used. All the cutting tools will build up a deposit of dried sap and this should be scrubbed off with steel wool at regular intervals and the tools sterilised. Hands should be clean and the faces of the grafts should not be touched or allowed to rest on the workbench. If this happens the affected cut should be re-done. The cutting board that touches one surface of the wedge should regularly be wiped sterile. Tools should be suspended rather than allowed to lie on any surface.

Ensure that binding tape does not come into contact with any contaminating surfaces and that your fingers do not transfer dirt onto the tape, and the graft area under the tape as it slips through your fingers when binding.

Binding tape

Plastrip is commercially available. It is reasonably strong and has a 'memory' in that once it has been stretched, it will want to contract. It thus applies a tension for a

while after the binding has been tied off. A problem which can occur involves the binding rather than the tape itself. Uneven tension when binding will cause the tape to unravel to a certain extent in some areas but not in others. To obtain an even, strong tension from the start of the bind until the end requires practice. Too much tension will snap the tape, so the skill required is to keep the tension below snapping point all the time while binding. If the tension is uneven and it loosens, there will probably be air penetration and the graft interface will dry out and fail. Unfortunately, this is quite a common occurrence and is the cause of a high percentage of failures.

Buddy Tape and Parafilm both stretch more and cling to themselves, so do not need to be tied-off. Both degrade within a month or so, the Parafilm faster than the Buddy Tape, and as insurance against air penetration, one or the other should be bound over the Plastrip, eliminating the need for grafting wax. This also means that you will not have to tie-off

the Plastrip, the last few windings are loosely wound into the lowest leaves of the scion so that when undoing the bindings after some months, the Plastrip is merely unwound through the degraded Parafilm/Buddy Tape. All bindings will eventually have to be removed.

Time

The time between taking a stem off the mother plant to the end of the grafting operation should be as short as possible. When collecting in the field, it is recommended that the stems be placed into a plastic bag inside a cool box with ice bricks as soon as possible. If a long hike is involved, bags can be made-up of 'roofing sisalation', and together with an ice brick, keep the stems cool until one reaches the ice box. The perfect option is to take a stem from the mother plant in a stock bed or pot.

Below: Binding tapes used in grafting;
left = Plastrip; right = Buddy tape.



Speed is by far the most important during the 'carpentry' stage, where the cut faces oxidize rapidly when exposed to air; for example, a bite out of an apple turns brown quickly. Aim for a time of 20 seconds from first cut to completion of the bind.

Success rate improves when the scions are given a water treatment. Start on a long stem by trimming off the required number of leaves to allow for wedge-cuts, then cut off the scion to the required length, retaining about four leaves. Trim 5 mm off the base of the scion and immediately stand it in its own small container of purified water. Subsequent scions from the same stem are treated similarly and kept in row so that the longest in the water (10–15 minutes) is grafted first. The theory is that the scion is then 'full' of water and will have a tendency to 'push' or ooze water outwards, which will reduce air contact and oxidation of the cut face. In practice, when the knife is sharpened to a mirror finish, the presence of plenty of liquid seems to lubricate as the knife does its cut, which further reduces the tearing effect on the cells. There is a counter argument that cells swollen with water are more prone to compression damage by the cutting action, but a razor-sharp knife with the correct blade shape may balance this.

Temperature

Medium temperatures at the interface will slow down callus formation and higher temperatures will kill the new cells forming at the interface. A higher temperature will cause increased transpiration from the leaves, yet reducing the leaf area by snipping off a percentage leads to a progressive die-back of the leaf in *Mimetes*. Increasing shade levels can easily be done, yet continuous deep shade is counter-productive.

Shade cloth does not help much in hot winds and a single day in these conditions may see

weaker grafts fail. Foggers are an option, as is air conditioning, but the cheaper option is to restrict grafting to the cooler months. However this does not suit the prime grafting times of some Proteaceae. Creative pruning of the mother plants can be done to bring scions to readiness for the cooler months. This can be done in the middle of the growing season of *Mimetes* (that varies throughout the year depending on the species) which will stop inflorescence development in favour of multiple shoots.

Prime times for the scion

As a rule of thumb, the best time to harvest scions in all Proteaceae is the same as for taking cuttings, that is, at the end of the shoot extension period when the stems are of a certain hardness and maturity.

Stems from a *Mimetes* that has been pruned offer the best rewards if the pruning is done less than halfway through the normal stem extension period. The new stems will then likely not be able to invest in an inflorescence that season. As most of the *Mimetes* start to develop an inflorescence while the stem is still extending, with no hardening-off period, a scion taken too late (although it has formed an adequate callus) will produce florets instead of new shoots and will delay new shoot emergence on the scion for six months, remaining in a weakened state. A stem taken during the latter part of stem development prior to inflorescence initiation, if it is sufficiently long enough to yield four scions, will result in the top two forming florets later and the bottom two producing shoots. Earlier still, and the stem will be shorter, yielding perhaps three scions, but there will be a better chance of no florets initiating.

Scions can be successfully grafted when taken from immediately below the inflorescence during, and just after, seed drop in some

Mimetes. The end of the seed-set period coincides with the start of new shoot extension, below as well as above the inflorescence, but mostly, below. The apical meristem produces one or perhaps two new shoots, while up to 10 can be produced below.

There is a tendency for scions from shorter, older stems to be more reluctant to strike than scions from longer stems of younger plants. The older the plant, the shorter the new stems, which naturally yield fewer scions. Scions taken from fairly mature plants in the wild are reluctant to strike, so the best time for *in situ* plants would be during their first three years, or sooner.

Graft techniques

Wedge grafting

Stems from the scion mother plant often yield multiple scions. The lowest is cut off first and some of the lower leaves trimmed off with scissors and stood in water for 15 minutes. Leaves can be stripped off by hand if they do so cleanly. The rootstock is chosen by matching cambium diameters, and trimmed. A vertical cut is made into the rootstock (see opposite, above left); tapping with a light

VERTICAL CUT



WEDGE CUT



hammer is more accurate and safer in harder wood. Try to obtain a vertical cut three to four times the diameter; if it is too long, problems arise with wedge-cuts and if too short, problems arise with binding. The cut is held closed with a peg to avoid oxidation while the wedge is being cut. (see opposite above right).

Using the special knife A (see tools on page 42, opposite below right, and photos

A: *Leucospermum* rootstock with leaves removed, secured to the work bench within a plastic bottle to prevent disturbance to the fragile roots during the grafting process.

B: Removal of excess leaves from a *Mimetes* scion with snipping scissors.



A



B



A: Making a vertical cut into the rootstock.

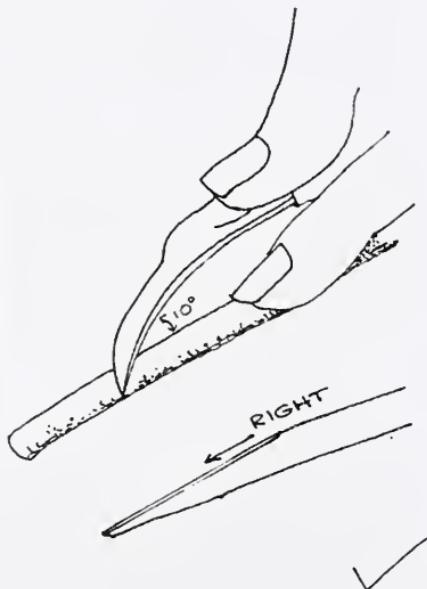
B: The vertical cut is held closed with a peg to prevent oxidation while the wedge graft is being cut.

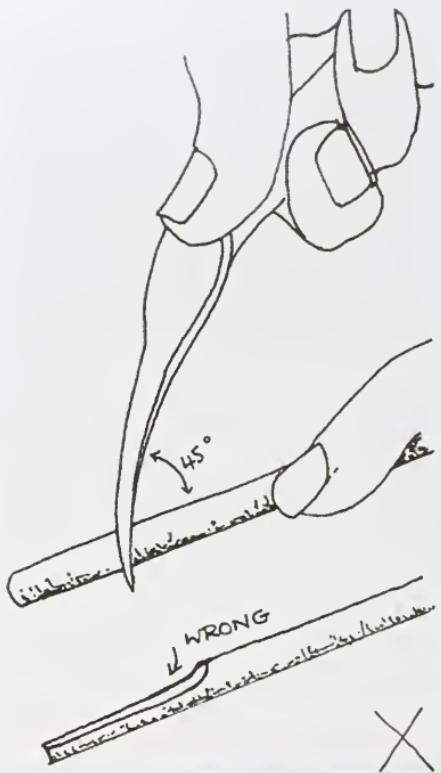
Opposite above: With wedge grafting, if the scion cambium layer is slightly wider than that of the rootstock, it will intersect four times and if smaller, it may not intersect at all. This shows two cambium layers of the same diameter, the perfect solution.

A and B on page 48) the wedge-cut is made with a single sweep of the blade. An inexperienced grafted will tend to dig the blade in before starting the long cut and this will result in an uneven, wavy cut, whereas the face of the cut should taper evenly from start to finish. For this cut, surprisingly, the body position is influential. Feet should be shoulder-width apart, one slightly behind the other, knees slightly bent. Keep both hands fairly close to the body with the elbows tucked in. To do the cut, all that is needed is a slight shift in body weight forward by 5 cm, with the muscle power driving through the back leg, leaving the hands to concentrate on guiding the blade.

The blade should at all times be parallel to the supporting cutting board to avoid an uneven thickness (side to side) at the thinnest point of the wedge. Note that the forefinger and thumb grip the scion while the forefinger is braced against the edge of the cutting board. Extra care is needed with this grip to avoid damage to the axil buds, especially if the wood is thick or hard, requiring a tighter

grip. In this case, shift the base of the scion to brace the cut-off end against the edge of the cutting board (see illustration below where the forefinger is braced), do the first cut, turn it over and brace again against the same place and do half of the second cut. Then shift the





Above: Incorrect method of performing a wedge graft.

Below, **A** and **B**: Making a wedge cut into the scion using the special knife.

scion onto the face of the board to support it and complete the cut.

Note that the knife blade swivels as it is pushed, i.e. the action is more of a push/slash that leaves a cleaner cut than only a push, which has more chance of tearing, especially if the blade is blunt. Note also that the back of the blade has been ground away so that there is little interference with the first leaf on the back of the blade, which would increase the angle of the cut. The scion is gently slid into position and bound with Plastrip and a second binding of Parafilm or Buddy Tape, instead of graft sealant.

It is easier as a right-handed person to bind in an anti-clockwise direction; left-handed grafters would do it clockwise. There is some fancy finger-switching and gripping of the Plastrip that needs practice, but a smooth and continuous bind with an even stretch is needed. The Plastrip should be gripped at the very end to accomplish the finger-switching. Note that the thumb can quickly pin down the Plastrip if there is a momentary easing of the bind tension. Three words of advice are – practice, practice, practice. A right-handed person should hold the end of the tape against the graft union with the left thumb



A



B



C

C: Inserting the scion into the vertical cut.



D

D: The scion is bound with Plastrip.

E: The scion is bound with a second binding of Parafilm or Buddy Tape.

F: The last few winds of the binding tape are wound loosely into the lowest leaves of the scion and the Parafilm is bound top to bottom over the binding tape.

G: Sealing the tip of the scion with an elastic graft sealant immediately after the graft has been completed.



F



E



G

and forefinger; stretch the tape to start the tension and then start winding, maintaining an even tension all the time.

The last few winds of the binding tape should be wound loosely into the lowest leaves of the scion, held in that position and the Parafilm then bound top to bottom over the binding tape (see page 49, photograph F). Tying-off the Plastrip is not needed; in a month or so the Parafilm will start degrading and after the graft has taken well, the Plastrip can be unwound through the Parafilm. Seal the tip of the scion with a sealant immediately after the graft has been completed. An elastic graft sealant is preferable to a tree seal.

The depth of the vertical cut into the rootstock should vary according to the age of the wood. Older wood is less supple and the binding has to be tighter, with more windings at the point just below the meeting point of the tip of the wedge and the deepest point of the vertical cut. More mature wood will naturally try to spring open and possibly split at that point

(graft tape stretches) and tends to allow a gap to open between rootstock and scion, to the detriment of callus formation. This springing action can occur underneath the binding and cannot be seen. A longer vertical and wedge-cut will decrease the angle and reduce the springing open action. If the rootstock is older and harder, the wedge faces of a younger scion, when forced into the vertical cut, can be damaged, in which case the vertical cut has to be prised open. With softer wood this attention to detail is not needed but preferably the age of both rootstock and scion should be about the same.

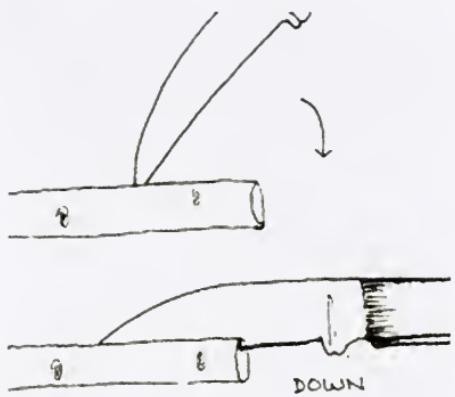
Rind grafting

This method allows for a much thinner scion to be grafted onto a thicker rootstock and is particularly suited to grafting the smaller proteas onto thicker, robust rootstocks like the *Protea* hybrid 'Pink Ice'. This technique is preferable, whenever possible.

Below: Callus formation of a wedge graft.

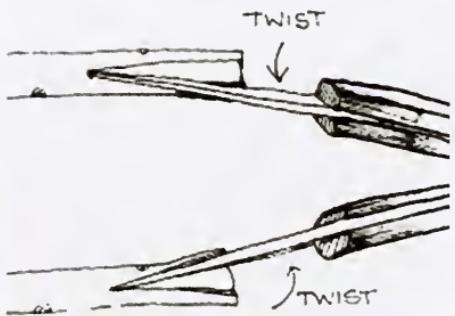


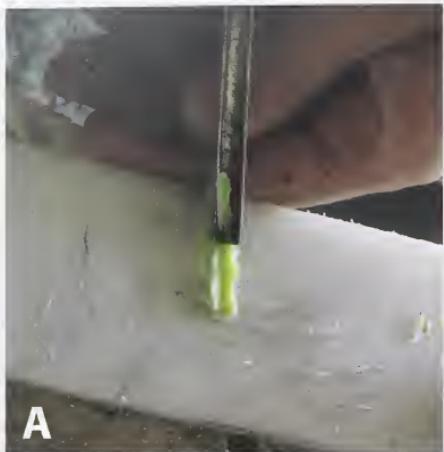
The top of the rootstock is cut off square and the first few leaves below that removed. A vertical slit, only as deep as the rind (bark), is made on the side of the rootstock and the rind prised apart. This can be done by pressing a straight blade down into the side of the stem rather than drawing the blade tip along the length of the slit. The blade, while still in the rind, can then be moved slightly to one side and then the other, using the tip of the blade as a fulcrum, taking care not to damage the cambium layer.



A: Using a grafting knife, a vertical slit is made on the side of the rootstock.

B: The rind is prised apart.



**A****B****C**

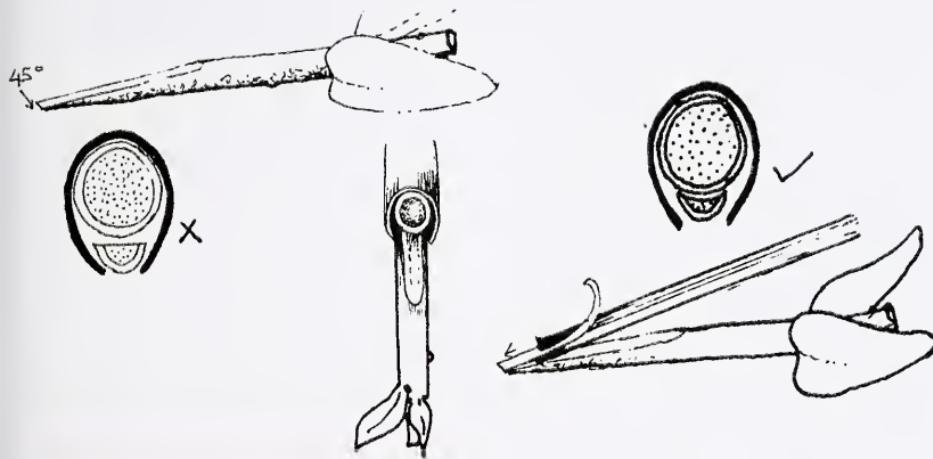
The bark of an immature primary stem will not peel off the cambium easily and often the twist action will shatter the layer where the cambium and xylem interface. Great care is needed in the 'down' movement of the blade so as not to go too deep; it is better to select a more mature rootstock. Another option is to make two or three slits and then carefully peel down the narrow strip(s) using your thumbnail. If this still damages the cambium layer, then a down-and-sideways peeling action can be used. The peels can be trimmed off once the tip of the scion is tucked behind them. The half-round woodcarver's chisel is used to scoop out some of the xylem of the scion, which will allow closer contact between the two cambiums (see A, left).

A and opposite right: The half-round woodcarver's chisel is used to scoop out some of the xylem of the scion, which will allow closer contact between the two cambiums as the scion can then flatten under binding tension.

B: The scion is trimmed at a sharp angle on the reverse side of the long slanting cut, to prevent crumpling when inserted between the rind and cambium layer.

C and **D:** The scion is slid into position.

**D**



Above: A problem arises when the flat cut face of a relatively large scion meets the round shape of the larger stock and the cambiums cannot come into close contact.

With very thin scions it helps to cut the tip off the thinnest part of the scion at a sharp angle, on the reverse side of the long slanting cut, so that the tip does not crumple as it is pushed between the rind and the cambium layer.

If the scion is very thin, the binding tape used can be Buddy Tape and this will cover the area of the square cut rootstock and the area where the scion protrudes above it. A very thin scion can easily snap under the strain of tensioning the Plastrip, while the Buddy Tape needs less stretching to cover adequately. However it is not as strong, nor does it have as good a 'memory' as Plastrip. If the scion is thicker and strong enough, then the stronger Plastrip should be used and covered with the Parafilm or Buddy Tape. If only Parafilm is used, it can degrade before the callus has consolidated and a further binding over the initial bind may be needed later.

Cambium Layers

It should be remembered that this layer is the thickness of only a few cells, so to match the scion to rootstock cambiums exactly along the entire length of the interface is impossible. It is far more likely that the two layers of the rootstock and scion will intersect a few times and these may be the only areas where they will match exactly. The two cambiums, kept in close proximity for some time, intersecting occasionally, is sufficient for a callus bridge to form. The rind graft allows the cambiums to match 'face to face'.

It is most important that there is as close a contact as possible between the two cambium layers for a bridge to form. Poor cambium proximity is one of the most significant contributors to graft failure.

With wedge grafting, if the scion cambium layer is slightly wider than that of the rootstock, it will intersect four times and if smaller, it may not intersect at all. The illustration at the top of page 46 shows two cambium layers of the same diameter, the perfect solution.

If one is forced to deal with a smaller or larger scion compared to the rootstock, the cambium match can be attempted along one side only. Another method is to make the vertical cut into the stock off-centre, to better match the thinner scion diameter. The scion can also be bound into position at a slight cross angle. The obvious solution is to have a wide selection of rootstock diameters available so that no wastage of rare scion material occurs.

A problem with cross-genus grafting is that often scion/rootstock cambium layer diameters are different, even though the outside stem diameters are closely matched. Trying to match cambiums according to outside diameter is counter-productive and the problem is compounded if their ages are different.

What part makes the best scion?

Only scions from the current year's growth should be taken. Older, woody scions have a history of failure or very slow callus formation. A scion with half the previous year's growth

Below left: longitudinal section of a stem showing the thin cambium layer.

Below right: Callus formation of a rind graft.

and half the current new growth also gives poor results. Soft new growth at the tip also has a poor result and should be trimmed off. A *Mimetes* scion taken from the mature apical meristem above the inflorescence site also gives a poor result and should not be attempted. Scions from a mature or senescent plant yield poor returns. An 18 cm stem from new, luxuriant growth will have to lose about 3 cm off the top that will allow three scions of 5 cm each, which are only just long enough to work with. Shorter scions can be taken, provided that the axil buds are clear and healthy. The reason for longer scions is that they have more axil buds, in case any start to develop after grafting and then fail and need to be trimmed off; there being more axils below the failures. New shoots are extremely brittle and can break off at the lightest touch, such as when weeding.

Just after seed-drop, the inflorescence can be trimmed off at the lowest bud site and two to three scions can be removed below that. With *Mimetes*, new shoots develop immediately below the inflorescence, and these are the optimal scions to use. Scions taken lower down are unreliable as their axils may be exhausted and while they will form a callus, they will not produce new shoots.



Leaf miner larvae seriously affect the viability of scions and *ex situ* plants should be sprayed with a suitable systemic insecticide when new shoots are in active growth.

Axil exhaustion and leaf flop

When grafting rare plants like certain *Mimetes* species, there is a need to maximize the number of scions per stem. This often leads to taking a stem from the mother plant that is too long, with the result that the lowest scion is too mature and the highest too immature.

Taking a long stem is not necessarily detrimental to the mother plant as its overall strength can produce new shoots if the stem is taken in spring or until midsummer (depending on the species). *Orothamnus* resents removal of long stems that are changing colour from green to brown, while *Mimetes stokoei* stems can be pruned 1 cm above the junction with the main stem and still produce shoots from there.

The lowest scion that has already used some reserves to support the formation of the stem above it will have to further drain itself to form a callus. It is frustrating to end up with a slow but good callus, yet a scion that is unable to produce a shoot. The top-most scion appears to have the reverse result in that the stem in that area has had little time to mature and build up reserves, and a callus bridge cannot form quickly enough to supply the young transpiring leaves.

The result is leaf flop and die-back from the tips of the leaves. This is a common occurrence with *Mimetes* scions that are still actively growing. Trimming these new leaves to reduce transpiration often causes the young leaves to die back progressively, causing the scion to fail.

Axil buds that are potentially exhausted can be identified. They are often brown and

desiccated, less vibrant than those higher up, or have fallen off completely. This is not to say that if there are no buds, the scion is of no use. *Mimetes argenteus*, for example, has small buds and often no sign of them at all, yet they shoot easily, whereas those of *M. hottentoticus* and *M. stokoei* are always prominent. It is during the later stage of stem extension that *Mimetes* develop these buds as potential initiators of florets. Not all turn into florets though, as it appears as if they start developing well before floret initiation, but only form florets when the time is opportune, leaving incompletely developed, potential florets below. If these upper potential florets are included in a scion, the relevant hormones may be switched on in response to the grafting wound and produce florets. Closer to seed drop, this portion just below the flower heads does not develop florets.

This phenomenon applies much less to *Leucospermum* and *Protea* as they produce fewer buds, and shoot well from 'blank' axil buds.

Compatibility/delayed incompatibility

Cross sections performed on grafted plants that have failed for various reasons have shown there is no obvious rejection between scion and rootstock at the interface of the graft. However, various signs point to some or other form of incompatibility, rather than a rejection arising from a cellular mismatch. As it manifests itself at flowering time, it is possible that early failures of grafted plants that are not mature enough to flower could have been attributed to other, possibly pathogenic causes, or delayed incompatibility might have occurred. This occurs in *Mimetes chrysanthus*, *M. hottentoticus*, *M. splendidus* and *Orothamnus* when a flowering event takes place at the wrong time, and it is as if the plant is confused as to whether it should grow leaf shoots or

flower; it is as if graft unity of rootstock and scion has not matured.

It is possible there is a roots/leaves signal disharmony between the scion and an 'alien' rootstock, and hormones are reaching the right place but at the wrong time. This could occur over a period of a year or more, and the plant drains itself of reserves due to stop/start growth signals.

Younger plants, when under stress from planting out, are probably more susceptible to this effect, often because they are too immature to flower and cannot show this aberrant growth, and fail. As young plant failure can have multiple causes, including poor 'carpentry', disharmony cannot be blamed in all cases. It is probable that the grafted plant matures past a disharmony stage, as mature plant failures are few.

My attempts to graft *Mimetes argenteus*, *M. hottentoticus* and *M. splendidus* onto a single *Leucospermum* rootstock all ended in disharmony. They all formed calluses and started producing new shoots, at different times, but then failed, at different times. The rootstock survived, but must have been very confused by the signals it received. *Mimetes hottentoticus* flowers a little earlier (early summer) than *M. argenteus* (midsummer). *M. splendidus* does so some three months later, while the *Leucospermum conospermon* rootstock flowers in late winter/spring.

Two, three and even five grafts of different *Leucospermum* species onto the same *Leucospermum* rootstock have been done successfully. As the flowering periods are very much the same, it suggests a more harmonious accommodation of rootstock/scion signals.

Balancing stock/scion growth

Pruning stimulates new shoots, and this is what is done to the rootstock at grafting time. A strong, established rootstock would far rather stimulate its own growth than the scion of a different genus, so even the smallest new shoots which develop on the rootstock should immediately be rubbed off, as once these adventitious shoots start, it seems that the denial of growth impetus to the scion progresses to a point where the scion's growth is critically slowed. This is evident in reluctance of the scion to produce new shoots, axil bud deterioration, partial leaf wilting and a general appearance of dehydration. Rootstock shoot development can also be the manifestation of scion/rootstock disharmony, thus nipping out new rootstock shoots is a form of force-training the rootstock into a new way of life with a new partner. Once the development of the scion is well underway, the rootstock shoots stop and the remaining leaves of the rootstock fall off.

Inspections of callusing

Unwinding the tape too soon is unproductive and potentially damaging. It is better to adopt the philosophy 'if it's not dead, it's all right'. Callusing is only noticed after 30 days or more and at this stage is fragile if the binding is removed and re-bound; the callus development at this stage is visible only with a 10x eyeglass. A full inspection to check on callus development, if an experiment is being conducted, requires the graft to be torn open.

Removal of bindings

Removing the binding too soon will result in damage to the callus area due to desiccation, and may even result in failure, whereas leaving it too late will result in girdling, which is less serious. It is best to wait until one can see the swelling of the callus through the tape, usually

in the lowest portion of the graft wound. Parafilm or Buddy Tape should be used for re-binding when the tighter bindings are removed, as they biodegrade within a month or so. As an option, silver foil can be wrapped around the graft site to reflect the sun while the plant is being hardened-off.

Right: A *Leucospermum* rootstock adventitious shoot (right) is overpowering the *Orothamnus* scion (left).

Below: *Mimetes argenteus* can be grown on its own roots, but performs best when grafted onto *Leucospermum* rootstock.







Pests and Diseases

The most harmful diseases are fungal, and incidence of fungal invasion above and below the ground in Proteaceae is always related to temperature and humidity. Where temperatures are above 18°C and this is accompanied by a relative humidity of 75% or more, fungal invasion can be expected in most species. Proteaceae plants, especially the grey-, blue-grey and hairy-leaved ones, cannot tolerate such conditions and can be badly damaged or killed by fungal invasion. Insect infestation of plants is also largely governed by climate. Insects either thrive or their numbers remain static depending on the temperature and moisture conditions prevailing. There are a number of ways to combat fungi and insects by paying attention to air movement, light levels and selecting the correct species or cultivar for a particular location. Natural and biological measures are often sufficient to enable Proteaceae to be grown satisfactorily in a garden, but when they are being grown commercially it is usually necessary to use chemical controls to ensure that they are kept clear of any infestation. The best control for fungal diseases is to provide good air movement around the plants.

Contact and systemic chemicals are the two basic types used to control fungi and insect pests. Contact sprays work by forming a total cover of chemical that envelops the plant and is effective until it becomes oxidized or weathers off. The systemic types work by entering the plant's sap system. Plants should never be sprayed with any chemicals when they are under stress from dehydration or from any other causes. In addition they should not be sprayed in full sun if the temperature is above 25°C. The safest and best cover is obtained when sprays are applied in the morning, just as the foliage is drying off from overnight dew.

Above: Fungal leaf spots on *Leucadendron strobilinum*.

Opposite: *Leucadendron argenteum* is especially susceptible to *Phytophthora cinnamomi*.

There are obvious advantages to cultivating proteas in their natural habitat in the south-western Cape in South Africa, where the climate and soil conditions are generally favourable. However, it is also a fact that pests and diseases that have evolved together with African Proteaceae are often a bigger problem in their land of origin than in other countries. These pests and diseases do, however, have the potential to become a problem not only in the protea production areas in South Africa, but also where proteas are grown in other countries. It is therefore important to implement the necessary control measures to ensure healthy, disease-free plants. Control measures start with good sanitation practices in the nursery, orchard and greenhouse. A guide to diseases and pests of commercial fynbos has been provided by the Agricultural Research Council (Lubbe 2006).

Pests

Caterpillars

Caterpillars or larvae of butterflies and moths are important pests affecting Proteaceae. Those of the Pine Emperor Moth (*Imbrasia cytherea*) can cause serious leaf damage to commercial Proteaceae fields, especially *Leucospermum* species planted near pine plantations. They also occur in the wild on *Faurea*, *Leucospermum*, *Mimetes* and *Protea* species.

The Protea Webworm (*Bostra conspicaulis*) spins copious webs on the leaves and flower heads, causing extensive damage.

Protea Leafworms (*Antheua eatocaloides*), Protea Loopers (*Illa nefanda*), Protea Leaf Rollers (*Tanyzancha* spp. and *Diocosma* spp.) and the Carnation Worm (*Epichoristodes acerbella*) consume proteaceous leaf tissue, causing serious damage. Leaf-miner caterpillars such as the Blotch Leaf Miner

(*Proteaphagus capensis*), Thin-line Leaf Miners (*Phylloconistis* spp.) and Channel Leaf Miners (*Eucosma* spp.) form narrow tunnels within the leaf tissue.



Above: A Pine Emperor Moth caterpillar consuming the leaves of *Mimetes fimbriifolius*.

Below: Damage to leaves of *Protea coronata* by Leaf Miner caterpillars.



Caterpillar borers of the Black Moth (*Argyroploce* sp.), the Speckled Protea Borer (*Oraphia* sp.), the Protea Butterfly (*Capys alphaeus*) and the Flat-headed Protea Borer



Above: Blister-like galls on leaves and stems of *Brabejum stellatifolium* caused by gall wasps.

Below: Leaf distortion in *Leucospermum catherinae* caused by maggots of the Protea Midge.



(*Sphenoptera* spp.) bore into the young leaf shoots or flower head buds, causing die-back or malformation.

Pick off by hand, spray with a natural spray containing pyrethrins, or in severe infestations, use a carbaryl- or cypermethrin-based insecticide.

Gall wasps

The leaves and stems of *Brabejum stellatifolium* are sometimes attacked by gall wasps whose developing larvae give rise to unsightly blister-like leaf galls. Intervention is usually not warranted but in severe outbreaks, spraying with cypermethrin may be necessary.

Midges

Maggots of the Protea Midge or Tip Fly attack the new leaves of *Leucospermum*, causing severe malformation. Preventative control can be achieved safely by using a systemic insecticide containing the active ingredient imidacloprid.

Nematodes

Plant parasitic nematodes or roundworms are microscopic, soil-borne, worm-like organisms. Root-knot Nematodes (*Meloidogyne* species) are a serious pest problem on *Leucospermum*, particularly in warmer climates, causing galls on the roots which result in stunting and chlorosis, and in severe instances, death. Control is extremely difficult as it is unfortunately not possible to kill the nematodes without also killing the host plant. Preventing nematode infestation in the first instance is the best option by only planting very healthy plant material.

Scale

There are several different types of soft scale which live on the undersides of the leaves or occasionally on the stems, but always out of direct sunlight. They suck the sap and reach peak population levels in late autumn



and will persist through the winter, causing dehydration of the leaves. They secrete honeydew which ants consume, upon which a black mould develops. Control can be achieved safely by using a systemic insecticide

containing the active ingredient imidacloprid or on contact by using a mineral oil.

Snout beetles

Several species of night-feeding snout beetle (*Afroleptops* spp., *Thamnobia* spp., *Eremnus* spp. and *Euderes* spp.) are extremely destructive to the leaf blades and margins, mainly in species of *Protea*. Using a bright torch, place a cupped hand or container beneath the plant and shake the culprits off, then crush their hard exteriors. Alternatively, spray with a cypermethrin-based insecticide.

Squirrels

At Kirstenbosch considerable damage is caused to ripening *Leucospermum* seeds which are consumed by North American Grey Squirrels. These rodents are extremely difficult to control and the best course of action is to place wire netting cages with an inner layer of gauze around the old flower heads.

Tipwilters (Stinkbugs)

These hard-bodied insects suck the sap from new tip growth in spring and early summer, causing wilting, and are especially partial to



Protea cynaroides. Pick them off by hand or in severe outbreaks, spray with a cypermethrin-based insecticide.

Witches broom

A microscopic organism known as a phytoplasma causes the development of dense clusters of abnormal leaves. It occurs in the wild as well as in cultivation (especially in *Protea cynaroides*, *P. nerifolia* and *P. nitida*) and is transmitted by mites. Infected plants should be removed and burned, as no control measures exist.



Above: A Tipwilter on *Protea cynaroides*.

Below: Witches broom infestation of *Protea cynaroides* (left) and *P. nitida* (right).

Opposite above: Snout beetle damage to the leaves of *Protea cynaroides*.

Opposite below: Damage to the flower heads of *Leucospermum* by North American Grey Squirrels.



Diseases

Anthracnose (Tip die-back)

The fungus *Colletotrichum gloeosporioides* usually attacks young shoot tips and new leaves, resulting in leaves becoming necrotic and shoot infections surround the stem, causing tip wilt and death. The disease may kill individual branches and the whole plant may die. Preventative control is best by avoiding overhead irrigation and spraying new growth flushes in warm weather with mancozeb. Diseased material has to be cut away and burned.

Blight

Blight is caused by aerial fungi. Infection with *Botrytis cinerea* is seen as brown spots with silvery spores on young shoot tips, leaves, flower buds and flower heads, causing tip die-back, especially in wet and humid weather. *Drechslera dematoidea* infection results in reddish-brown lesions on the leaves and flower buds, usually on current growth.



Above: Tip die-back in *Protea cynaroides*.

Below: Blight in *Protea cynaroides* (left) and *Leucospermum conocarpodendron* (right).



The best course of action is preventative, by providing good air movement around the plants and spraying preventatively with mancozeb). Cut off and discard all affected material in dry weather and avoid overhead watering to reduce infection.

Leaf-drop

When grown in containers, some proteas such as *Leucadendron argenteum* have a tendency to drop their lower leaves. Drenching the leaves and soil with a systemic fungicide containing the active ingredient triforine (e.g. Funginex), which has a low toxicity to wildlife, helps prevent this.

Leaf spots

Various fungi (e.g. *Batcheloromyces* spp., *Coleroa senniana*, *Leptosphaeria protearum* and *Pestalotia* spp.) cause a range of leaf spot diseases which manifest as red, brown, yellow, purple or black spots or lesions. These can be raised above the healthy tissue or sunken within it and can cause death of whole leaves. Infected



Above and below: Leaf spots in *Leucadendron laureolum* (above), *Leucospermum patersonii* (below left) and *Protea magnifica* (below right).





leaves should be removed and burned, and in highly susceptible areas, preventative spraying with mancozeb or soil drenching with a broad-spectrum systemic fungicide containing fosetyl may be necessary in autumn and spring.

***Phytophthora* (Root rot)** The virulent pathogen *Phytophthora cinnamomi* is the most important root disease of proteas and causes heavy losses, mainly in summer. It is present in many soils throughout the world and affects protea plants wherever they grow. Spores are waterborne and multiply very rapidly in wet soils at temperatures above 18°C (e.g. during heavy summer rains or under irrigation). The most important symptom of root rot is wilting of the entire plant from the lower leaves upwards, followed by yellowing. Removal of the external bark exposes a dark patch of rotten bark extending from the crown into the root. *Phytophthora* cannot be cured and by the time the symptoms are noticed, it is too late to save the plant.

The best control is preventative and cultural, by providing good air circulation around the plants, watering in the early morning, planting shallow-rooted groundcovers to keep the soil cool and not disturbing the proteoid roots by refraining from weeding around the plants. Application of thick mulches increases the level of beneficial soil fungi and bacteria which suppress and retard *Phytophthora* activity. A systemic fungicide containing the active ingredient fosetyl can be applied preventatively, but this is expensive. Affected plants should be removed immediately and burnt, and Proteaceae should not be planted in the same spot for several years. *Phytophthora* is present on gardening tools and these should be washed clean of soil and regularly treated with a detergent or disinfectant solution. Secateurs blades should be disinfected with methylated spirits.

Scab (Corky bark)

The fungi *Elsinoë* spp. cause raised, circular reddish lesions to develop on the stems and leaves of current growth, causing distortion. The condition arises in moist conditions with moderate temperatures and chemical treatment is only successful when applied preventatively; spraying actively growing plants with mancozeb is recommended. *Leucospermum cordifolium* is particularly susceptible.

Stem cankers

Caused by fungi (e.g. *Botryosphaeria* spp.), stem cankers are sunken patches that are darker in colour than the surrounding

tissue. They result in death of branches and eventually the whole plant may die. The fungi enter through wounds such as those made by pruning, picking and insects, and are prevalent in moist weather. Its incidence is reduced by sterilising pruning tools and controlling insect attack.

Wilt

The fungus *Fusarium oxysporum* causes leaf blackening and a black lesion to develop from the roots upwards for about half of the stem, causing die-off of the stem and eventually the whole plant. The only control is preventative; by disinfecting the soil with a soil fumigant prior to planting.

Opposite: *Leucadendron argenteum* killed by *Phytophthora*.

Below: First sign of *Phytophthora* infestation in *Leucospermum*.







Major Genera

Protea (Sugarbushes)

Comprising about 115 species, *Protea* is the largest and most widespread genus of the family in South Africa. It is centred in the south-western and southern Cape and occurs from the Bokkeveld Escarpment in the north-western Cape (*P. laurifolia*, *P. repens*) to the Cape Peninsula and in an easterly direction to northern Limpopo (*P. caffra*, *P. gaguedi*) extending northwards into tropical parts of Central, West and East Africa. *Protea repens* is the most commonly encountered species and has the widest distribution (Rourke 1980).

Growth habit varies enormously from dwarf, ground-hugging shrublets like *P. aspera* to large trees up to 8 m high such as *P. rubropilosa*, but most species form medium-sized shrubs. The flower head is characterised by an involucre of colourful bracts which enclose a mass of individual flowers within. Flowering takes place mainly from late autumn to spring (May to September) and pollination is effected mainly by scarab beetles, nectar-feeding sunbirds and sugarbirds in species with large showy flower heads, whereas insects and nocturnal rodents pollinate those with inconspicuous brownish, often strongly yeast-scented flower heads. Most proteas are adapted to fire cycles and in the majority of these the plants are killed by fire, but regeneration occurs from seeds. In a few species, regeneration occurs from persistent subterranean rootstocks or lignotubers which resprout several months after fire, these include *P. cynaroides*, *P. nubigena* and *P. speciosa* (Rourke 1980).

Above: *Protea scolymocephala*

Opposite: *Protea repens* has the widest distribution of all proteas in South Africa.

Proteas produce hard, narrow, nut-like seeds which are densely covered with long, straight brown or black hairs. The seeds of some species are released two to four months after flowering but most are termed serotinous as they are retained within the old flower heads for extended periods and only released after wild fires or when the plant dies. *Protea* seeds are dispersed by wind (anemochory) with the aid of hairs which provide buoyancy and upon landing they assist in anchoring the seed onto the soil (Rebelo 2001). A number of *Protea* species are highly threatened in the wild (Rebelo *et al.* 2006, see <http://redlist.sanbi.org>).

Cultivation

Proteas require full sun and a well ventilated position in well drained, nutrient-poor media. Soil disturbance has to be kept to a minimum and most species need slightly acid ground, although *P. obtusifolia*, for example, occurs naturally on limestone deposits but easily adapts to acidic media in cultivation. Proteas are wind resistant

and drought tolerant once fully established and benefit greatly from mulching with well-rotted pine needles during dry summers, as experienced in the winter rainfall area of the Western Cape, for example. The taller species like *P. laurifolia* and *P. neriiifolia* make excellent informal, colourful screens and hedges whereas medium-sized shrubs like *P. burchellii* and *P. cynaroides* are ideal for mixed fynbos gardens and rock garden pockets. Dwarf species like *P. nana* and *P. scolymocephala* make charming container subjects. Proteas are outstanding cut flowers and attract nectar- and insect feeding birds to the garden. Depending on the species, their lifespan in the garden varies greatly from about 8-10 years for *P. compacta* to at least 30 years for *P. laurifolia*, in ideal conditions. *Protea* species are generally more cold-tolerant than leucospermums, mimetes and serrurias, but slightly less so than leucadendrons,

Below: *Protea rubropilosa*, a summer rainfall species that can grow up to 8 metres high.



with the exception of *P. obtusifolia* which is half-hardy and can only tolerate temperatures down to freezing for very short periods.

Propagation

Protea species are propagated from seed or cuttings, or rarely by grafting. Seed is generally the more successful method, but to preserve particular genetic traits, cuttings have to be used.

Seeds are sown from late summer to autumn (March to April), once night temperatures have decreased noticeably to 10°C or lower. The seeds are dusted with a systemic fungicide containing the active ingredient metalaxyl and sown in seed trays placed in a sunny position in a well-drained, sterile medium such as 8 parts finely milled pine bark and 3 parts coarse sand. To obtain the optimum pH of 4.5-5.5, lime should be added to very acid media. Cover the seeds with a thin layer of coarse sand or finely milled bark, and keep moist but not wet. Applying a smoke treatment (see page 33) will improve germination in many species. Germination periods vary from 3–4 weeks (e.g. *P. cynaroides*) to 3 months (*P. stokoei*). Growth rate and seedling juvenile periods vary widely, for example fast-growers like *P. lanceolata* and *P. scolymocephala* can flower in their second year whereas slow-growing species like *P. aristata* and *P. grandiceps* usually flower in their sixth year. For most species, flowering in the third or fourth year can be expected, in ideal conditions.

Cuttings are taken from midsummer to early autumn (December to March) and these should be 60–100 mm long and from the current season's growth. Remove the leaves from the basal third and dip the cutting into a rooting hormone solution for 4 seconds

or hormone powder before inserting into multitrays in a well drained rooting medium such as 50% finely milled pine bark and 50% polystyrene beads, place in a growing house with 25°C bottom heat and intermittent mist. Once strong rooting has taken place, remove trays from bottom heat and harden-off for three weeks, then grow-on for a year until plants are ready for planting out.

Pests and diseases

Members of the genus *Protea* with hard, needle-like leaves such as *P. aristata* and *P. nana* have very few insect pests, but those with broader leaves are subject to numerous pests including stinkbugs, snout beetles, caterpillars, midge flies, leaf miners, scale and gall insects, as well as mites which transmit a phytoplasma between plants and cause witches broom (see page 63).

Proteas are also subject to a range of fungal diseases of which the root rot fungus caused by *Phytophthora cinnamomi* is the most important. Susceptibility to *Phytophthora* varies greatly amongst the species, from those that are strongly resistant to it, like *P. lanceolata* and *P. laurifolia*, to those that are highly susceptible, including *P. burchellii* and *P. stokoei*.

Other fungal diseases include wilting caused by *Fusarium oxysporum*, flower head blight caused by *Botrytis cinerea*, Anthracnose caused by various *Colletotrichum* species, Canker caused by various *Botryosphaeria* species, Blight caused by *Drechslera dematioidea*, Scab caused by *Elsinoë* and *Sphaceloma* species, and a wide range of leaf spot diseases (see pages 65–66).

Recommended *Protea* species

(For an explanation of cultivation symbols and hardiness ratings see page 17).

Protea aristata



Common names: Ladismith Sugarbush, Kleindennesuikerbos (A)

Height: 2–2.5m Spread: 1–3m

Flowering time: October to December

This spectacular, mainly summer-flowering species occurs on sandstone rocky slopes of the Klein Swartberg in the vicinity of Ladismith in the southern Cape. The plants are killed by fire and regenerate from seed but they are vulnerable to too frequent fires, which have resulted in a decline in population numbers.

The pleasing grey-green, needle-like leaves contrast beautifully with the reddish pink flower heads and the plant has a compact, neat habit. It performs well in sharply drained sandstone soils and easily adapts to granitic media as long as they are well drained. This is a long-lived but slow-growing species and an ideal subject for mixed fynbos gardens or rock garden pockets. It is very waterwise once fully established.

Propagation is best from seed.

Protea aurea subsp. *aurea*



Common name: Common Shuttlecock Sugarbush

Height: 3–5m Spread: 1.5–2.5m

Flowering time: January to June



Above: *Protea aristata*

Below: *Protea aurea* subsp. *aurea*



Forming an erect large shrub or small tree, *P. aurea* is native to the southern Cape and consists of two subspecies, subsp. *aurea* and subsp. *potbergensis*. The subsp. *aurea* occurs on south-facing mountain slopes from Geyton in the west to George in the east.

In cultivation this is a vigorous, fast-growing plant with a lifespan of about 8–10 years. Its attractive shuttlecock-like flower heads vary in shades of white-green, pink or crimson. It is suited to large fynbos gardens, and planted as a hedge it forms an effective windbreak, and can also be grown as a specimen tree. This is an adaptable protea, growing easily in any well drained, acid soil.

Propagation is best from seed, and seedlings can reach 3m high within 4 years.

Protea aurea* subsp. *potbergensis



Common name: Potberg Sugarbush

Height: 3–5m Spread: 1.5–2.5m

Flowering time: April to July

Protea aurea subsp. *potbergensis* is confined to the Potberg and adjacent coastal flats of the southern Cape.

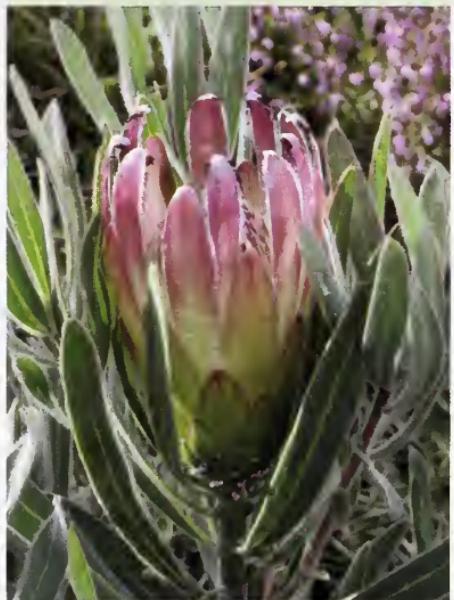
It differs from subsp. *aurea* in its larger, oval-shaped leaves whose new growth has a striking velvety covering and short hairs along the margins, and in its larger, creamy green flower heads, and commences flowering three months later. Cultivation advice mirrors that of subsp. *aurea*.

Propagation is best from seed.



Above: *Protea aurea* subsp. *potbergensis*

Below: *Protea burchellii*



Protea burchellii



Common names: Burchell's Sugarbush, Blinksuikerbos (A)

Height: 1–2.5m Spread: 1–3m

Flowering time: June to August

This valuable horticultural subject forms a multi-branched, spreading shrub and occurs in a variety of soils on flats and lower mountain slopes in the south-western Cape. On the West Coast it is found around Piketberg and Hopefield, as well as inland in the Upper Breede River Valley and from the Cape Flats to the Hottentots Holland Mountains. It is under threat in the wild from expanding agriculture.

The flower heads range in shades of greenish yellow and pink, with a light to prominent black beard. *P. burchellii* adapts well to cultivation and, depending on local provenance, will grow in sandy or clay soils. It must have full sun and, with its medium height and spreading habit, is ideal for mid-layer plantings in mixed fynbos gardens and can also be grown as a specimen plant. It is suitable for rock garden plantings in semi-arid areas, becoming very waterwise once established. This species readily forms hybrids in cultivation.

Propagation is from seed or cuttings.

Protea compacta



Common names: Bot River Protea, Botrivierprotea (A)

Height: 2–3.5m Spread: 1–2.5m

Flowering time: April to September, with a peak from May to June

The Bot River Protea is an erect, sparsely branched, lanky shrub endemic to foothills and sandy flats from the Palmiet River mouth to just east of Cape Agulhas in the southern Cape.

The striking long, cup-shaped, bright pink or occasionally creamy white flower heads are produced on long, sturdy stems and are widely cultivated for the cut flower trade. The plants require acid, well drained soil in full sun and readily adapt to granitic media. They are best grown in groups to provide mutual support for the long branches and prevent bushes from falling over in strong wind. They are recommended for large, mixed fynbos gardens. In order to maintain this species in the garden over the long-term, the shrubs should be replaced every 8–10 years. The plants can take salt-laden wind and attract insect-eating birds. Young plants should be staked and pinched back to encourage bushiness, and spent flowering stems should be pruned back hard to within the leaf zone to encourage new shoots. This is a vigorous, fast-growing species and a prolific bloomer.

Propagation is best from seed. Unightly leaf blackening occurs in cut stems after a day or two, due to water loss through transpiration after picking. The problem is greatly reduced if stem bases are immersed in water as soon as possible after picking and kept at low temperature until arranged in the vase.

Protea coronata



Common names: Green Sugarbush, Groenhofesuikerbos (A)

Height: 2–5m Spread: 1–2m

Flowering time: April to September, with a peak in May and June



Above: *Protea compacta*

Below: *Protea coronata*



A fast-growing, upright, medium to large shrub with a disjunct mountainous distribution from the southern and northern Cape Peninsula to Napier in the southern Cape, in the Langeberg and Outeniqua Mountains between Riversdale and George, and much further east in the eastern Tsitsikamma Mountains and the Zuurberg near Uitenhage.

The striking apple-green flower heads have a pure white beard and are partially enclosed by long erect, smooth or hairy leaves. This fast-growing, easily cultivated species occurs naturally in stony clay soils but easily adapts to a wide range of well drained acid media in cultivation, including granitic soils. It is suited to large fynbos gardens and is best planted in groups to prevent bushes from falling over in strong wind. Spent flowering stems should be pruned back hard to encourage bushiness. The shrubs are fairly short-lived and need replacing about every eight years.

The flower heads are visited by many nectar-feeding birds and insects including the Green Protea Beetle.

Propagation is best from seed, and seedlings can reach 2 m in four years, in ideal conditions. The leaves are susceptible to fungal disease, thus a position in full sun with good air circulation is required.

Protea cynaroides



Common names: King Protea, Grootsuikerkan (A), Koningsuikerbos (A)

Height: 0.3–2m Spread: 0.5–2m

Flowering time: All year round, with a peak from May to September



Above: *Protea cynaroides* 'Elliptica'



Above: *Protea cynaroides* 'Little Prince'



Below: *Protea cynaroides* 'King White'



Below: *Protea cynaroides* 'Red Rex'

This splendid, extremely variable species has a wide distribution from the Gifberg south of Vanrhynsdorp to just east of Grahamstown.

Its considerable local forms exhibit remarkable variation in leaf shape, colour of the involucral bracts and flowering time. Leaf shape in the western and south-western parts of its range is rounded or oval, becoming increasingly narrow-elliptical towards the south and east. The flower heads are equally variable, from large cup-shaped heads up to 0.3m in diameter in the south-west and south, to obconical ones just 0.14m in diameter in the east.

The King Protea is one of the easiest and most adaptable proteas in cultivation, and is the national flower of South Africa. The plants regenerate from a subterranean lignotuber after fires and will also sprout new shoots if old flowering stems are cut back hard to just above ground level. This is a fairly fast-growing plant once established. In the wild it always grows on well-drained, acid, sandy soil derived from Table Mountain Sandstone. Although it thrives in well-drained sites, it is a water-loving species and grows naturally in damp areas. In cultivation though, it is fairly waterwise once established. The smaller forms are suitable for containers and for growing under glass. Honey bees and the large Green Protea Beetle are attracted to the flowers, feeding on pollen and nectar (see page 28).

The deep red cultivar 'Red Rex' produces outstanding small- to medium-sized, obconical flower heads with white florets from August to October and having long stems, is an outstanding cut flower. The cultivar 'Madiba' has large obconical, bright pinkish red flower heads with greyish pink florets. A white cultivar, 'King White' has recently become available in the trade. The dwarf cultivar 'Little Prince' has a small flower head about 14 cm

in diameter with pink bracts, and flowers from June to September. It is ideal for deep containers, as is the cultivar 'Elliptica' which grows to only 0.6 m high and has narrowly elliptical leaves.

Propagation is best from seed, but cuttings strike fairly easily and are used to propagate particular genotypes. The leaves can take light frost but flower heads will be damaged. *P. cynaroides* is very susceptible to fungal leaf spots (see "Leaf spots" on page 65).

Protea eximia



Common names: Broad-leaved Sugarbush, Breëblaarsuikerbos (A)

Height: 2–5m Spread: 0.7–1m

Flowering time: July to December, with a peak from August to October

This erect shrub is common in the southern Cape and its range extends from the Keeromsberg near Philipsdale in the Western Cape to the Van Staden's Mountains west of Port Elizabeth in the Eastern Cape.

A fast-growing, sparsely branched species with broad leathery, greyish or purplish green foliage, the bold, erect flower heads have brilliant pinkish red inner involucral bracts. One of the easiest species to grow, it adapts well to a range of soil types including acid sandstone and granitic soils, and slightly alkaline media. It is best grown in groups of three plants or more to provide mutual support in wind-prone areas, and performs well in coastal gardens and on the Highveld. It is drought tolerant once established and an excellent cut flower. Light pruning after flowering, and the removal of old flower heads encourages bushy new growth. It is highly favoured by nectar-feeding birds and



Above: *Protea eximia* 'Fiery Duchess'

Below: *Protea grandiceps*



Robbie Thomas

attracts the large Green Protea Beetle. The cultivar 'Fiery Duchess' is an especially strong grower with deep pinkish red inner bracts and a prominent white fringe, flowering from September to November. This species is an excellent choice for the beginner.

Propagation is equally successful from seed or cuttings.

Protea grandiceps



Common names: Red Sugarbush,
Rooisuikerkan (A)

Height: 1–2m Spread: 2–3m

Flowering time: September to January, with a peak from December to January

An easily cultivated, attractive and compact, tidy, rounded shrub with a wide distribution in high mountainous terrain from Table Mountain in the northern Cape Peninsula to the Great Winterhoek Mountains near Uitenhage in the Eastern Cape.

The broad, oval, blue-green foliage with its prominent reddish margins provides a striking contrast with the bright coral-pink or red flower heads which have a white or maroon fringe to each inner involucral bract. Although very slow-growing, this is a decorative, long-lived garden shrub for group planting in mixed fynbos beds. It produces excellent, long-lasting cut flowers. The plants require well-drained, acid soil in full sun and appreciate moderate watering throughout the year.

Propagation is best from seed. The leaves are prone to blight infection (see page 64).

Protea lanceolata



Common names: Lance-leaf Sugarbush, Smalblaarsuikerbos (A)

Height: 2–4m Spread: 1–3m

Flowering time: April to October, with a peak from May to July

This erect, multi-stemmed shrub is endemic to coastal limestone flats of the southern Cape from the Potberg to Mossel Bay.

The greenish cream involucral bracts open widely to expose white flowers whose nectar is highly prized by sunbirds and honeybees. The flower heads are not especially showy but this fast-growing, long-lived species has several uses in the garden. The reddish stems have a dense covering of erect, narrow leaves, making it an excellent choice as a windbreak or screening plant, and it performs well in coastal gardens. It is easily cultivated in poor, slightly alkaline soils and adapts readily to a range of other soil types including granitic loam and gravelly clay, and is strongly drought tolerant.

Propagation is best from seed.

Protea laurifolia



Common names: Laurel-leaf Protea, Louriersuikerbos (A)

Height: 4–8m Spread: 2–4m

Flowering time: April to November, with a peak from May to July

Forming a large bushy shrub or small tree, this vigorous protea is native to inland mountains from the Bokkeveld near Nieuwoudtville to



Above: *Protea lanceolata*

Below: *Protea laurifolia*



the Riviersonderend Mountains and east to the Witteberg and Anysberg.

The flower heads are deceptively similar to those of *P. nerifolia* but the leaves of *P. laurifolia* differ in being elliptical and glaucous, and have short petioles, with very leathery margins. In the garden, this species is highly recommended for its longevity, reaching 30 years in ideal conditions. It is drought tolerant, grows in a range of soil types including slightly alkaline clay and neutral media, and is an excellent large screening plant or subject for a large hedge.

Propagation is equally successful from seed or cuttings although seedlings are slow to reach maturity; their first blooms usually appearing after seven years.

Protea lepidocarpodendron



Common names: Black-bearded Sugarbush, Swartbaardsuikerbos (A)

Height: 2–3m Spread: 1–2m

Flowering time: April to August, with a peak in July

A bushy coastal shrub with heavily black-bearded inner involucral bracts, this light greenish yellow- or rarely pink-flowered species occurs along the coast from the Cape Peninsula to the Kleinrivier Mountains near Stanford in the southern Cape.

This is a vigorous and fairly long-lived plant that will last about 10 years or more in the garden with regular removal of old flower heads and pruning. Although not the showiest species, it is an asset in the garden as it adapts well to a variety of acid soils including granitic media and is attractive to nectar-feeding birds. It is useful in coastal



Above: *Protea lepidocarpodendron*

Below: *Protea longifolia*



fynbos gardens for its tolerance of salt wind, and it makes a satisfactory cut flower with the removal of the uppermost leaves.

Propagation is best from seed.

Protea longifolia



Common names: Long-leaf Sugarbush, Langblaarsuikerbos (A)

Height: 0.5–1.5m Spread: 1–2m

Flowering time: May to September, with a peak from June to July

A sprawling, winter- and spring-flowering shrub, *P. longifolia* is native to fynbos of coastal hills and mountain slopes from the Hottentots Holland Mountains to the Soetanysberg near Cape Agulhas. Its wild populations are vulnerable mainly to habitat loss and alien plant invasion.

Easily recognised by its prominent, black-bearded, extended central flowers, this plant has variable involucral bract colour, with numerous forms in shades of yellowish green, creamy white or light orange-pink. It readily hybridises with other species in the wild as well as in cultivation, including *P. compacta*, *P. neriiifolia* and *P. repens*. This is a fast grower in well-drained, acid soils but tends to become 'leggy' without removal of old flower heads and careful pruning after flowering to encourage bushy new growth. Smaller forms are well suited to gardens with limited space, and it makes a reasonable cut flower.

Propagation is best from seed.

Protea magnifica



Common names: Queen Protea, Wolbaardsuikerbos (A)

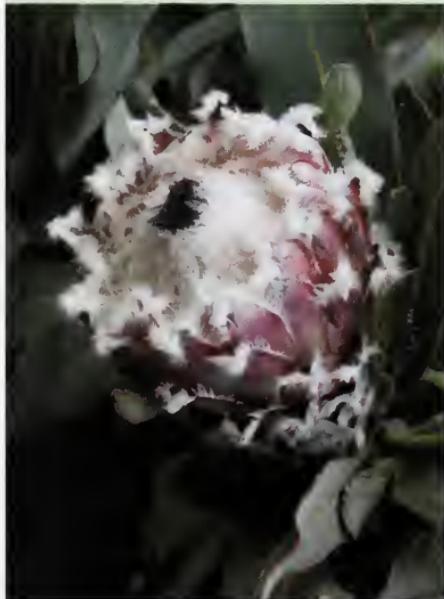
Height: 0.5–3m Spread: 1.5–3m

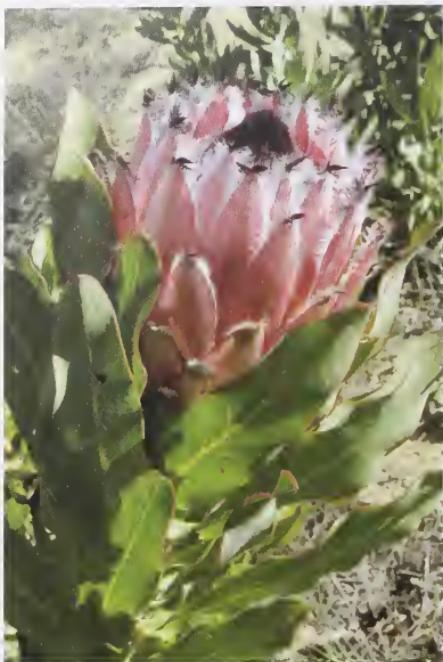
Flowering time: June to January

One of the most spectacular species, this robust sprawling shrub is native to higher elevations from the Cederberg, east to the Langeberg Mountains near Riversdale and inland to Seweweekspoort near Ladismith in the Little Karoo.

The striking blue-green or greyish, leathery leaves contrast effectively with the colourful involucral bracts, which vary markedly from locality to locality, from light to deep pink and carmine, to greenish cream or light yellow; all with woolly white or brown margins. *P.*

Below: *Protea magnifica*





Above: *Protea magnifica* (bright pink form)



Above: *Protea nana*

Below: *Protea mundii*



magnifica is slow growing, but long-lived in suitable conditions. It requires a sharply drained, acid soil, as much sun as possible and excellent air movement around the plants as its leaves are highly susceptible to leaf spot fungal disease. It is an excellent cut flower and hybridises readily with several species including *P. burchellii*, *P. longifolia* and *P. nerifolia*. It is waterwise once well established.

Propagation is best from seed although seedlings are slow to develop and usually take six years to flower.

Protea mundii



Common name: Forest Sugarbush

Height: 3–8m Spread: 1.5–2m

Flowering time: January to September, with a peak from February to April

This fast-growing plant forms a large, erect shrub or small tree and has a disjunct distribution; its major range stretches from the Outeniqua Mountains near George to the Strydomsberg range near Uitenhage, and it also occurs along a short coastal strip between Betty's Bay and Hermanus.

The creamy green or pink flower heads are not especially showy but this species is of great use in large gardens as an effective hedge or screening subject, in attracting birdlife to the garden and in its tolerance of slightly alkaline soils and semi-arid conditions. It is one of the easiest species to grow and is long-lived, easily reaching 20 years.

Propagation is equally successful from seed or cuttings.

Protea nana



Common names: Mountain Rose, Skaambloem (Af)

Height: 0.8–1.3m Spread: 0.5–1m

Flowering time: July to October

A rounded, small bushy shrub with a limited distribution from Michell's Pass at Ceres and the Grootwinterhoek Mountains near Tulbagh to the Du Toits Kloof Mountains near Worcester.

The slender arching branches are covered with needle-like leaves and bear pendent flower heads with light to deep red, or sometimes green, involucral bracts. Its low-growing habit and neat appearance make it ideal for small gardens, preferably rock garden pockets where minimal root disturbance is likely to take place, and for deep containers. It requires a very well-drained, acid sandstone or granitic soil, full sun and good air movement around the plants. The cut stems have an excellent vase life and branches need pruning after flowering to maintain a compact shape. In ideal conditions this species has a lifespan of only about 10 years in cultivation and new plants should continually be propagated from seed to replace mature bushes.

Plants are easily propagated from seed and are fast growing, reaching 0.5 m by the end of their third year. Cuttings grafted onto the *Protea* hybrid 'Pink Ice' result in more floriferous plants. *P. nana* is susceptible to *Phytophthora* (see page 66).



Protea neriifolia



Common names: Oleander-leaf Protea, Baardsuikerbos (A)

Height: 2–5m Spread: 2–3m

Flowering time: February to November

This large, colourful shrub or small tree has a wide distribution in sandy, acid soils derived from Table Mountain Sandstone, occurring from the Kleinwinterhoek Mountains near Tulbagh to the Elandsberg near Port Elizabeth.

Considerable variation occurs in involucral bract colour, mainly in shades of pink and to a lesser extent, creamy green, with velvety black or white tips. This is one of the most reliable proteas for the average garden; not only as an ornamental shrub, but also as a generous provider of cut flowers. It is also highly attractive to nectar-feeding birds. The very attractive cultivar 'Red Robe' has deep pinkish red flower heads with a black beard and light yellow florets, and flowers from May to July.

Above left: *Protea neriifolia* (pink form)

Above right: *Protea neriifolia* (cream form)

Below: *Protea neriifolia* 'Limelight'

Opposite: Cream (left) and red (right) forms of *Protea obtusifolia*.



The luminous greenish yellow cultivar 'Limelight' is also highly recommended. *P. nerifolia* has wide tolerance of growing conditions including semi-arid areas, acid or slightly alkaline soils, as a windbreak or hedge, and coastal gardens. It is an ideal species for the beginner.

Propagation is equally successful from seed or cuttings.

Protea obtusifolia



Common names: Limestone Sugarbush, Bredasdorpsuikerbos (A)

Height: 2–4m Spread: 2–3m

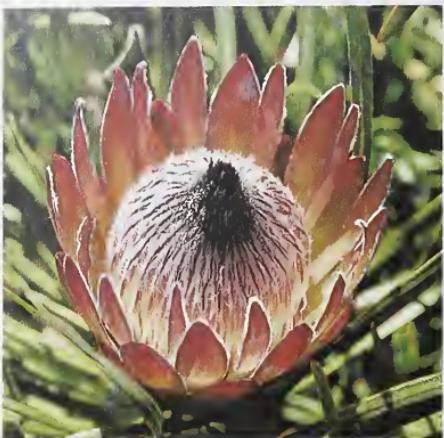
Flowering time: April to September, with a peak from June to July

Forming a neat, spreading shrub, this species has an entirely coastal range, occurring on low hills and flats from Hawston to the Gouritz River Mouth in the southern Cape.

It is one of very few members of this genus that occurs exclusively on limestone deposits, thus it is of great use to those who garden in difficult coastal areas with alkaline soils as it tolerates a pH of up to 8.4, and also performs well in acid and clay soils. Involucral bract colour ranges widely in shades of pink to dull red, and there are also a number of greenish or creamy white forms. The plants are barely tolerant of very light frost, but stand up very well to salt-laden wind. This is a long-lived shrub, lasting up to 20 years or more, provided old flower heads are removed regularly and some pruning takes place after flowering. It is a generous provider of long-lasting cut flowers.

Propagation is best from seed.





Protea pudens



Common names: Bashful Sugarbush, Aardroos (A)

Height: 0.3–0.4m Spread: 0.5–1m

Flowering time: May to September, with a peak from July to August

This beautiful dwarf species forms a prostrate shrub and has an extremely limited distribution along the coast of the southern Cape between Elim and Bredasdorp. It is endangered in its habitat due to agricultural expansion and invasive alien plants.

The trailing horizontal branches bear erect, linear leaves which usually have hairy margins and the bell-shaped flower heads have dusky, deep pink involucral bracts and a prominent black, woolly cone in the centre. *P. pudens* responds well to cultivation and is most suitably grown in rock garden pockets, allowed to sprawl over low retaining walls or in deep containers. It performs well in acid or slightly alkaline, sandy or clay soils. The plants tend to become leggy with age, thus careful pruning within the leaf zone is essential after flowering. Cut flower stems are useful for small arrangements.

Propagation is best from seed.

Protea punctata



Common names: Watersugarbush, Waterwitsuikerbos (A)

Height: 2–4m Spread: 2–3m

Flowering time: December to June, with a peak from March to April

Occurring exclusively in montane habitat from the Cederberg in the Western Cape to the Kouga Mountains of the southern Cape, *P. punctata* grows in semi-arid conditions and forms a large rounded shrub or small tree.

Its striking glaucous, leathery leaves provide splendid contrast against the light or deep pink flower heads, of which the inner involucral bracts become strongly outspread when in full flower. This plant adapts well to cultivation in drier areas with very well-

drained, acid soils and full sun. It can be used as a hedge or screening subject, and the flower heads are attractive to honeybees and nectar-feeding birds.

Propagation is from seed or cuttings.

Protea repens



Common names: Common Sugarbush, Suikerbos (A)

Height: 1–4.5m Spread: 1–3m

Flowering time: All year round, mainly March to October in the Western Cape and September to March in the Eastern Cape

The most widely distributed of all proteas, *P. repens* occurs from Nieuwoudtville in

Below: *Protea repens* 'Guerna'

Opposite above: *Protea pudens*

Opposite below: *Protea punctata*



the north-western Cape to just east of Grahamstown in the Eastern Cape.

Its habitat includes well-drained, dry, sandy flats and lower to middle hill and mountain slopes. It is usually a gregarious plant, occurring in colonies.

The very showy flower heads have sticky, shiny involucral bracts and the flower head contains a never-ending stream of sticky nectar. There are a number of local colour variants, ranging from white to pink and deep crimson or, alternately, white with pink tips. For the beginner, this species is one of the best choices to make as it adapts to a range of soil types including acid and slightly alkaline clays and sandy media. Flower heads appear reliably every year; it is long-lived and waterwise, and suitable for growing under glass. It is also highly attractive to nectar-feeding birds, honeybees and other insects.

There are several outstanding cultivars, of which the reddish pink 'Rubens' is one of the most desirable, flowering from January to March. The cultivar 'Guerna' is recommended for its deep red flower heads.

Propagation is equally successful from seed or cuttings.

Protea roupelliae* subsp. *roupelliae



Common names: Silver Sugarbush, Silwerblaarsuikerbos (A)

Height: 3–8m Spread: 3–5m

Flowering time: All year round, with a peak from February to April

A long-lived and vigorous, small to large, rounded tree with a wide distribution on rocky slopes in the summer rainfall area, this subspecies occurs from the northern part of

the Eastern Cape to Limpopo and extends north into Zimbabwe.

It has a spreading crown, silvery green, smooth or hairy leaves and showy flower heads with pinkish red involucral bracts edged with silvery hairs. A species for medium-sized or large gardens, it performs well in both summer and winter rainfall areas, adapting readily to a range of well-drained, slightly acid soils. Inland, high altitude forms should be moderately to strongly hardy whereas coastal forms can take light frost. This is an excellent choice for attracting sunbirds and butterflies to the garden, and several butterfly larvae feed on its leaves.

Propagation is best from seed; as it occurs in the summer rainfall area, seeds are sown in early summer.

Protea roupelliae subsp. *hamiltonii*



Common names: Dwarf Silver Sugarbush, Ranksilwersuikerbos (A)

Height: 0.3–0.7m Spread: 0.5–1m

Flowering time: October to December

This attractive plant is confined to eastern Mpumalanga and is critically endangered due mainly to encroaching forest plantations and invasive alien plants.

It differs from subsp. *roupelliae* in having a low, spreading, multi-branched habit. Its involucral bracts are light yellow or light to deep pink and it has bright green, leathery leaves. It is very rare in cultivation but long-lived when

Below left: *Protea roupelliae* subsp. *roupelliae*

Below right: *Protea roupelliae* subsp. *hamiltonii*



grown in a suitable position, such as in well-drained rock garden pockets.

Propagation is as for subsp. *roupelliae*.

Protea rubropilosaa



Common names: Transvaal sugarbush; Transvaalbergsuikerbos (A); segwapi (NS)

Height: 1–8 m Spread: 3–5 m

Flowering time: September to December, with a peak in October

Forming a small to large shrub or tree, this beautiful summer rainfall protea is native to high altitude woodland on steep south-facing sandstone slopes along the Drakensberg escarpment in Mpumalanga and Limpopo.

The showy pinkish-red flower heads are complemented by a neat growth habit and the plants bear striking bright green leathery leaves which provide excellent contrast



against clusters of reddish new foliage. This slow-growing species is very long-lived in suitable conditions, developing an interesting gnarled trunk with deeply-fissured bark. It likes well drained, sandstone or granitic soils in full sun. Although occurring naturally at high altitude in a summer rainfall region, it has easily adapted to a winter rainfall climate and much lower altitude at Kirstenbosch, and established specimens perform admirably despite dry summers. It is best suited to large rock gardens. The plants are remarkably resistant to pests and diseases.

Propagation is difficult, but best from seed.

Below left: *Protea rubropilosa*

Below right: *Protea scolymocephala*



Protea scolymocephala



Common names: Thistle Sugarbush, Witskollie (A)

Height: 0.3–1.3m Spread: 0.5–1m

Flowering time: August to October

This much-branched, low-growing, rounded shrub is endemic to deep sandy flats and occasionally heavy clay and occurs from the Gifberg south of Vanrhynsdorp to the southern Cape Peninsula, with a disjunct population near Hermanus on the south coast. Its numbers are declining in parts of its range due to agricultural expansion.

The neat, rounded growth form, small, flared, yellowish green flower heads and narrow, greenish grey foliage combine to form a pleasing, low-growing plant for the rock garden, mixed fynbos bed or deep container. It is a fairly long-lived species, lasting about 10 years, and is suited to acid sandy or granitic

soils in summer-dry, windy coastal gardens with full sun. Light pruning of the branches after flowering is essential to encourage new shoots and keep the plants bushy. As a cut flower, its long-lasting blooms are excellent for small arrangements (see photograph on page 89).

Propagation is best from seed, often flowering in their second year.

Protea speciosa



Common names: Brown-bearded Protea, Baardsuikerbos (A)

Height: 0.5–1.2m Spread: 0.5–1m

Flowering time: June to January, with a peak from September to October

A slow-growing, small shrub from sandstone slopes of the Cape Peninsula and Hottentots Holland Mountains, extending east to Bredasdorp and the Langeberg near Riversdale.

Like *P. cynaroides*, this species has a subterranean lignotuber, from which it sprouts new shoots following wildfires. The satin-pink or light yellow involucral bracts are thickly bearded with brown and the leaves are leathery and vary considerably in shape across the distribution range.

Recommended for small fynbos gardens and deep containers, this species is slow-growing and seldom reaches over 1 m high. It produces relatively few flowering stems and these require heavy pruning to just above ground level to stimulate new shoots. The



Left: *Protea speciosa*

Opposite: Watercolour painting of *Protea stokoei* by Vicki Thomas.



Protea stokoei

— Abramov —

plants adapt well to granitic soils in cultivation and are waterwise once established. The cut stems are excellent for the vase but the leaves are susceptible to fungal spots.

Propagation is best from seed.

Protea stokoei



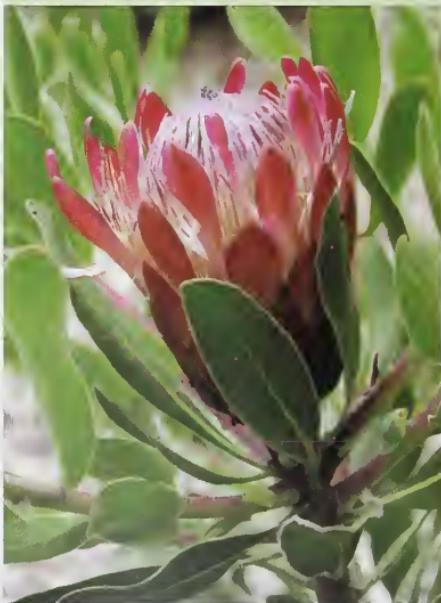
Common names: Pink Sugarbush, Blosendesuikerbos (A)

Height: 1.5–3m Spread: 1–2m

Flowering time: May to October, with a peak in May and June

The Pink Sugarbush is a magnificent erect, medium-sized shrub endemic to the Hottentots Holland, Groenlandberg and Kogelberg ranges. It occurs at high altitude on moist south-facing

Below: Reddish-pink form of *Protea susannae*



slopes and is endangered as a result of too-frequent fires, amongst other causes.

A remarkably slow-growing species, *P. stokoei* is one of the most difficult proteas to maintain in cultivation over the long-term, although the seeds germinate easily and cuttings are easily grafted (Robbie Thomas, pers. comm.). It requires an acid, well-drained medium containing fully decomposed organic matter. It also requires a cool environment with excellent ventilation, one in which it will not overheat on very hot days, preferably receiving morning sun and afternoon shade.

It is suited to mixed plantings with other fynbos species and could also be grown in deep containers. The satin-pink flower heads are highly attractive to Cape Sugarbirds and have an excellent vase life.

Propagation is from seed, or grafting onto protea hybrid rootstock such as 'Pink Ice'. It is highly susceptible to *Phytophthora* (see page 66).

Protea susannae



Common names: Stink-leaf Sugarbush, Stinkblaarsuikerbos (A)

Height: 2–3m Spread: 3–4m

Flowering time: April to September, with a peak from May to July

Native to the southern Cape coastal belt in a narrow strip from Gansbaai to Stilbaai, this fast-growing shrub occurs in dense stands in neutral and alkaline sandy soils.

It is one of the easiest proteas to grow although most forms are not especially showy, but good forms do exist and these should be selected and propagated vegetatively. Although the leaves emit an unpleasant

sulphur-like odour when crushed, this plant is of great use to gardeners in being tolerant of salt-laden wind and drought, and sandy, alkaline soils, yet adapts very well to acid, granitic media. It is long-lived and an ideal species for the beginner. Its plentiful nectar attracts sunbirds, sugarbirds and honeybees. This is a vigorous species which can reach 3 m high in 8 years, and needs to be kept in check by hard pruning after flowering.

Propagation is equally successful from seed or cuttings.

Right: *Protea repens* is long-lived in cultivation and adapts to a range of soil types.

Below: *Protea neriiifolia* 'Red Robe' is a generous provider of cut flowers.





Leucospermum (Pincushions)

One of the most colourful fynbos genera, *Leucospermum* has 48 species, most of which are endemic to the south-western and southern Cape (Rourke 1972). Its distribution forms an arc stretching from western Namaqualand (*L. praemorsum*) in the north-western Cape to the Cape Peninsula, Eastern Cape, KwaZulu-Natal, Swaziland, Mpumalanga and Limpopo, north to eastern Zimbabwe (*L. saxosum*). Like that of *Protea*, growth form is extremely diverse amongst the species which mostly form low, spreading shrubs but vary from sprawling groundcovers (*L. prostratum*) to small trees (*L. patersonii*).

The genus name is derived from the Greek *leukos* (white) and *sperma* (seed), and is descriptive of the white- or light-coloured seeds of many of the species. Flowering takes place mainly from midwinter to midsummer (late June to late December) and the major pollinators are sunbirds, sugarbirds, bees and beetles. The nut-like seeds are released continuously as they ripen, first from the older, outermost flowers, then inwards from the younger, inner flowers. The seeds are dispersed by indigenous ants (myrmecochory) which carry them to their nests and consume the oily elaiosome, following which the seeds germinate once favourable conditions prevail (Bond *et al.* 1991). Many *Leucospermum* species are threatened in the wild (Rebelo *et al.* 2006, see <http://redlist.sanbi.org>).

Below: *Leucospermum oleifolium*

Opposite: *Leucospermum reflexum* var. *luteum*



One of the most widespread species is *L. cuneiforme* which occurs in a coastal band from Riviersonderend in the southern Cape to Qolora in the Eastern Cape and is one of few members with a persistent rootstock that re-sprouts after fire; most leucospermums are killed by fire and regenerate from seed.

Cultivation

As with all Proteaceae, pincushions require full sun and a well-ventilated position in well-drained, nutrient-poor media. Soil disturbance has to be kept to a minimum and most species need slightly acid ground, although *L. patersonii* occurs naturally on limestone deposits but easily adapts to acidic media in cultivation. Pincushions are wind resistant and drought tolerant once fully established. They benefit greatly from mulching with well-rotted pine needles during dry summers, as is experienced in the winter rainfall area of the Western Cape, for example. The larger species like *L. conocarpodendron* and *L. reflexum* make excellent informal, colourful screens and hedges whereas medium-sized shrubs like *L. cordifolium* and *L. tottum* are ideal for mixed fynbos gardens and rock garden pockets, and dwarf species like *L. muirii* and *L. prostratum* make charming container subjects. Many pincushions are outstanding cut flowers and attract nectar- and insect-feeding birds to the garden. Most species have a lifespan of about 10 years, after which replacement becomes necessary. The plants are generally less tolerant of frost than *Protea* and *Leucadendron*, with the possible exception of high altitude forms of *L. reflexum* and *L. tottum*, but will survive temperatures down to 0°C for short periods of a few hours.

Propagation

Pincushions can be successfully propagated from seed or cuttings but certain species including *L. glabrum*, *L. grandiflorum*, *L. muirii*

and *L. tottum* are often more successful from cuttings as their seeds germinate erratically. Seeds are sown from late summer to autumn (March to April), once night temperatures have decreased noticeably to 10°C or lower. Soaking seeds in a 1% hydrogen peroxide solution for 24 hours will loosen the seed coat, which should be rubbed off. The seeds are then dusted with a systemic fungicide containing the active ingredient metalaxyl and sown in seed trays placed in a sunny position in a well-drained, sterile medium such as 8 parts finely milled pine bark and 3 parts coarse sand. To obtain the optimum pH of 4.5–5.5, lime should be added to very acid media. Cover the seeds with a thin layer of coarse sand or finely milled bark and keep moist but not wet. Applying a smoke treatment (see page 33) will improve germination in many species although in some it is unnecessary, such as *L. bolusii* (Malan & Notten 2003). Germination periods vary from 3–4 weeks (e.g. *L. cuneiforme*) to 2 months (*L. conocarpodendron*) but in *L. glabrum* they may only germinate a year later (McQuillan 2008a). Seedlings are generally fast growing and usually flower in their third or fourth year although those of *L. lineare* can flower as early as the second year (Nurriish 2013).

Cuttings are taken from midsummer to early autumn (December to March) and these should be 60–100 mm long and from the current season's growth. Remove the leaves from the basal third and dip the cutting into a rooting hormone solution or hormone powder before inserting into multitrays in a well-drained rooting medium such as 50% finely milled pine bark and 50% polystyrene balls, then place in a growing house with 25°C bottom heat and intermittent mist. Once strong rooting has taken place, remove trays from bottom heat and harden-off for three weeks and grow-on for about a year until the plants are ready for planting out.

Pests and diseases

Pincushions are not overly subject to insect pests, however the new leaves of several species including *L. catherinae*, *L. conocarpodendron* and *L. formosum* are sometimes attacked by mites and leaf miners in summer and autumn, causing malformation (see page 61). Larvae of the Pine Emperor Moth are highly destructive in stripping the leaves of pincushions when grown near pine plantations, especially those of *L. cordifolium* (see page 60). Pincushion leaves are also sometimes subject to attack by leaf-roller caterpillars (see page 60).

Many pincushions are susceptible to fungal disease, and *L. cordifolium*, *L. grandiflorum*, *L. lineare*, *L. oleifolium* and *L. tottum* are especially susceptible to *Phytophthora*. Once plants have become infected they are impossible to treat in time, thus the best course of action is preventative, by ensuring suitable environmental conditions. These include providing a full sun situation, well-drained soil, watering in the early morning rather than the late afternoon, refraining from root disturbance by soil cultivation, and keeping the soil cool in summer by placing a thick mulch layer over the surface, which also helps to keep weeds at bay. *L. cuneiforme* and *L. conocarpodendron* subsp. *viridum* are fairly resistant to *Phytophthora* and the latter taxon is often used as rootstock material for grafting highly susceptible *Orothamnus zeyheri*, various *Mimetes* species and *Leucospermum patersonii*.

Leucospermum branch tips, flower buds and leaves are sometimes affected by a grey fungal mould die-back, as well as by the *Botrytis* fungus (see page 64).

Recommended *Leucospermum* species

(For an explanation of cultivation symbols and hardiness ratings see page 17).

Leucospermum bolusii



Common names: Gordon's Bay Pincushion, Witluisiesbos (A)

Height: 0.8–1.5 m Spread: 1–2 m

Flowering time: September to December

This decorative mound-forming shrub is confined to a narrow strip of rocky coastline from Gordon's Bay to Kogelbaai, east of Cape Town.

The many long, spreading branches arise from a single main stem and have small elliptical leaves with a soft, downy covering when young. An abundance of small, sweet-scented, creamy white flower heads cover the bushes from spring to midsummer and are



Right: *Leucospermum bolusii*

avidly visited by a variety of insects including honeybees, wasps, butterflies and moths. Equally well suited to landscape plantings and rock garden pockets, this is a long-lived plant in full sun and well drained acid sandstone soils, and easily adapts to granitic media. It is waterwise once well established and makes a good cut flower.

Propagation is from seed or cuttings.

Leucospermum catherinae



Common names: Catherine-wheel Pincushion, Wielblom (A)

Height: 2–3 m Spread: 1–2.5 m

Flowering time: September to December

This medium-sized shrub occurs in moist acid sandstone soils from the Cederberg and Piketberg to the Hex River Mountains in the Western Cape. It is endangered in the wild due to habitat degradation, too-frequent fires and overgrazing.

Noted for its long orange styles whose tips resemble a Catherine wheel in being bent in a clockwise direction, this species has large, yellowish green leaves which are deeply red-toothed at the apex and are narrowed below to form a short stalk. It is sometimes confused with *L. formosum* whose styles are similarly bent, but in the latter species they are yellow and the leaves are intensely silver-grey and hairy, without leaf stalks, and it has a more easterly distribution in the wild. *L. catherinae* is an outstanding garden subject for sunny, mixed fynbos beds and large rock gardens, and adapts well to granitic soils. The plants are relatively short-lived, usually reaching about 10 years before replacement becomes necessary. Light pruning after flowering encourages new growth and extends the

life of the plant. The flower heads are highly attractive to nectar-feeding birds and insects, including sugarbirds and honeybees.

Propagation is from seed or cuttings.

Leucospermum conocarpodendron subsp. *conocarpodendron*



Common names: Grey Tree Pincushion, Vaalkreupelhout (A)

Height: 2–5 m Spread: 2–5 m

Flowering time: August to December

A large rounded shrub or small tree with a sturdy gnarled trunk and branches, this yellow pincushion is confined to exposed, dry sites in granitic soil of the north-western Cape Peninsula. It survives fires quite well but is threatened by urban development and alien plant infestation.

The plant is immediately recognised by its silvery grey leaves with a thick covering of



short and long soft hairs, but the bright yellow flower heads are hardly distinguishable from those of subsp. *viridum*. This is a slow-growing, very long-lived pincushion with a neat, compact shape and is suited to large fynbos gardens in which it is allowed to grow to its full potential. It easily adapts to sandstone-derived soils and performs well on hot, north- or west-facing slopes. It can also be cultivated in large, deep containers. The flower heads attract nectar-feeding birds and insects and in a garden situation it is waterwise once well established and can live for 30 years or more in cultivation.

Propagation is from seed or cuttings.

***Leucospermum conocarpodendron* subsp.
*viridum***



Common name: Green Tree Pincushion

Height: 2–5 m Spread: 2–5 m

Flowering time: August to December



The most well known of the two subspecies, subsp. *viridum* is ubiquitous on sandstone soils in the Cape Peninsula (except the north-western part) with a disjunct population on the Cape Flats, then ranges eastwards from the Hottentots Holland Mountains to Stanford in the southern Cape.

Its habit is very similar to that of subsp. *conocarpodendron* but it differs in its glabrous, deep green leaves. Its mature size makes it suitable only for large fynbos gardens, or alternatively it can be grown in large containers. It requires the same growing conditions as subsp. *conocarpodendron*, and easily adapts to granitic soils.

Propagation is from seed or cuttings.

Below left: *Leucospermum
conocarpodendron* subsp.
conocarpodendron

Below right: *Leucospermum
conocarpodendron* subsp. *viridum*

Opposite: *Leucospermum catherinaeae*



Leucospermum cordifolium



Common names: Pincushion, Bobbejaanklou (A)

Height: 1–1.5 m Spread: 1.5–2 m

Flowering time: August to January

One of the best-known members of the genus and probably the first to be called 'pincushion', this species is confined to a narrow coastal strip of the south-western and southern Cape from the Kogelberg to the Soetanyasberg near Bredasdorp; and occurs on rocky sandstone slopes.

Forming a rounded, spreading shrub with a single main stem and horizontally radiating branches, it is widely cultivated both as a garden shrub and for cut flowers, and is suitable for growing under glass and in large, deep containers. The highly ornamental, long-lasting blooms decorate the shrubs for six to eight weeks from spring to midsummer

and inflorescences range from light to bright yellow or pink, deep orange or crimson, and there are many excellent cultivars including the bright yellow 'Yellow Bird', deep red 'Flamespike' and light orange 'Gold Dust'. This species adapts to various acid, well-drained soils including granitic media and is an outstanding choice for mass planting or as a specimen plant. The bushes flower prolifically and need regular pruning of flowering stems to stimulate new growth, prevent a 'leggy' appearance and lengthen the life of the plant. It is highly prized by nectar-feeding birds and honeybees.

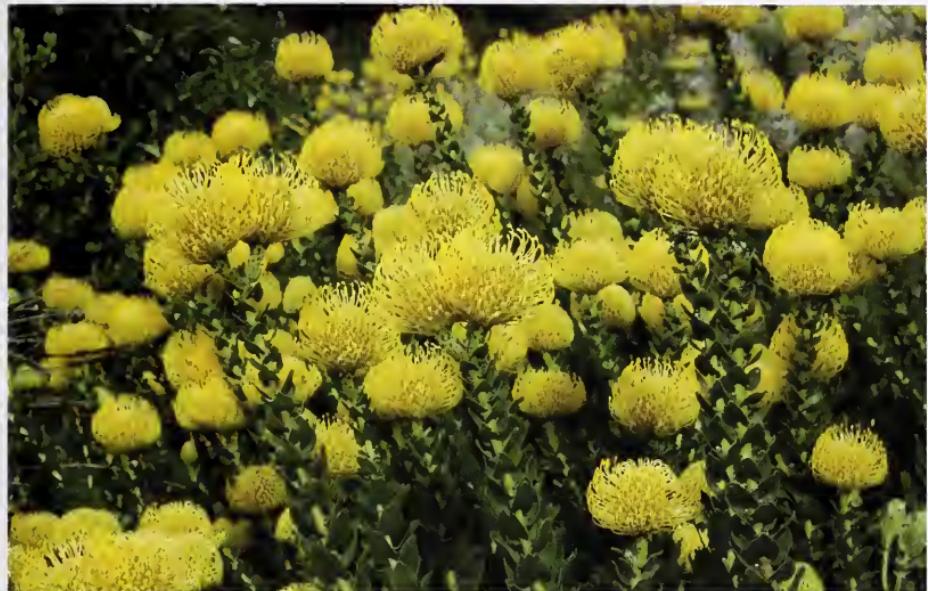
Propagation is from seed or cuttings.

Below: *Leucospermum cordifolium* with *Agathosma glabrata*

Opposite above: *Leucospermum cordifolium* 'Yellow Bird'

Opposite below: *Leucospermum cuneiforme*





Leucospermum cuneiforme



Common names: Wart-stemmed Pincushion,
Gewoneluisiesbos (A)

Height: 1.5–3 m Spread: 1.5–2 m

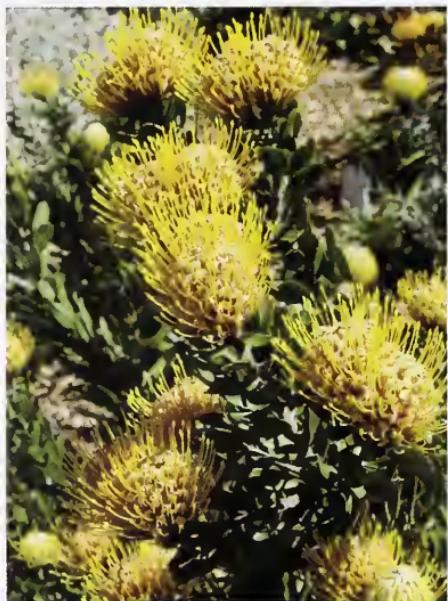
Flowering time: All year round, with a peak
from August to February

This variable, bright yellow-flowered, tall shrub
is one of the most widely distributed of all
the pincushions, occurring along the coastal
mountains from Riviersonderend to Qolora
in the Eastern Cape. Its habitat is sandstone
slopes and flats, and it has a persistent
lignotuber which re-sprouts strongly after
fires.

A long-lived, attractive species with distinctive
wedge-shaped, toothed leaves, this medium-
sized or large shrub bears bright yellow flower
heads and is ideal for large rockeries or mixed
fynbos gardens and can even be grown in
large containers. It adapts easily to well-

drained granitic soils and is waterwise once
fully established. It is wind tolerant, attractive
to nectar-feeding birds and makes a good cut
flower.

Propagation is from seed or cuttings.



Leucospermum erubescens



Common names: Oudtshoorn Pincushion, Oranjevlamspeldekussing (A)

Height: 1.5–2 m Spread: 0.8–1.2 m

Flowering time: August to January

An erect, strong-growing shrub with a limited distribution from the Warmwaterberg to the Langeberg in the southern Cape.

This is an outstanding pincushion for garden cultivation, with oblong leaves and large flower heads in clusters of four to eight, which transform from light yellow to orange and brilliant crimson at the branch tops as they age. It is highly recommended for arid fynbos gardens as it tolerates low winter rainfall conditions, yet is easily grown in high winter rainfall areas. The shrubs last up to 10 years in the garden and regular light pruning after flowering prolongs their lives. A well-drained, acid, sandy or granitic soil in full sun should be

chosen for this species. It is an excellent cut flower and highly attractive to nectar-feeding birds.

Propagation is from seed or cuttings.

Leucospermum formosum



Common name: Silver-leaf Wheel Pincushion

Height: 1.5–3 m Spread: 1–2 m

Flowering time: September to October

This medium-sized, spreading shrub is native to sandstone slopes from the Riviersonderend to the Outeniqua Mountains and its numbers are threatened by expanding agriculture.

It is easily confused with *L. catherinae* as its styles are similarly bent in a clockwise direction, but *L. formosum* differs in having light yellow styles and intensely silvery grey leaves without stalks.

The striking foliage and large flower heads provide excellent contrast against green-



leaved shrubs in the mixed fynbos garden and this is a fairly long-lived plant in cultivation, reaching about 10 years old. Regular light pruning after flowering is essential to stimulate new shoots. It is a satisfactory cut flower and its nectar is relished by sugarbirds and sunbirds, and a variety of insects.

Propagation is from seed or cuttings.

Leucospermum glabrum



Common name: Outeniqua Pincushion

Height: 2–2.5 m Spread: 1–2.5 m

Flowering time: August to October

This robust, multi-branched shrub grows on moist, acid soils on the lower slopes of the Outeniqua and Tsitsikamma Mountains in the southern Cape and it is endangered there due to alien plant invasion and commercial forestry.

The striking, dark green elliptical leaves have three to six apical teeth and the large, dark orange flower heads are borne singly at the tips of the branches and have conspicuous red pollen presenters. This vigorous pincushion is an outstanding garden plant and is especially showy in mixed fynbos plantings. It is free-flowering, easily adapts to granitic soils and is relatively long-lived, often reaching 15 years in ideal conditions. Its nectar-filled flowers are attractive to a variety of birdlife and it makes an excellent cut flower.

Propagation is from seed or cuttings.

Below left: *Leucospermum glabrum*

Below right: *Leucospermum grandiflorum*

Opposite left: *Leucospermum erubescens*

Opposite right: *Leucospermum formosum*



Leucospermum grandiflorum



Common names: Grey-leaf Fountain Pincushion, Luisiesboom (A)

Height: 1.5–2.5 m Spread: 1–2 m

Flowering time: July to December

This erect, multi-branched shrub is native to granitic hills in a small area of the south-western Cape near Durbanville, Malmesbury, Paarl and the Berg River Valley, and is endangered due to agricultural expansion and alien plant invasion.

Its distinctive grey, elliptical leaves have reddish apical teeth and the large yellow flower heads have conspicuous reddish pollen presenters. It thrives in well-drained granitic soils in full sun and tolerates relatively low winter rainfall, yet is not adversely affected when grown in high winter rainfall areas such as at Kirstenbosch. Its relatively small size



makes it suitable for small gardens, it is highly attractive to nectar-feeding birds and makes a good cut flower (see photograph on page 103).

Propagation is best from cuttings.

Leucospermum hypophyllocarpodendron subsp. *hypophyllocarpodendron*



Common name: Green Snake-stem Pincushion

Height: 0.10–0.2 m

Flowering time: August to January

A prostrate, mat-forming shrub endemic to sandy flats of the Cape Peninsula, Stellenbosch, Paarl and Bredasdorp, this subspecies is threatened by urbanisation, agricultural expansion and invasive alien plants.

It has a persistent rootstock and smooth, upright, narrow leaves with a single, terminal, scented, yellow flower head produced at the tips of horizontal stems. This is a plant for the specialist collector, suitable for well-drained rock garden pockets, for sprawling over retaining walls or for deep containers. It requires a well-drained, acid sandy medium in full sun, and once established is very waterwise.

Propagation is best from cuttings.

Leucospermum hypophyllocarpodendron subsp. *canaliculatum*



Common name: Grey Snake-stem Pincushion

Height: 0.1–0.2 m

Flowering time: August to January

Like the subsp. *hypophyllocarpodendron*, this plant has a prostrate, mat-forming growth habit and terminal yellow flower heads but it differs in its stems and leaves which are covered with hairs, and it has a wider distribution in the Western Cape, extending from Piketberg to the northern Cape Peninsula. Threats to its habitat are similar to those associated with subsp. *hypophyllocarpodendron*.

Subsp. *canaliculatum* is recommended for the specialist collector, for cultivation in sunny rock garden pockets or sprawling over retaining walls, and for deep containers.

Propagation is best from cuttings.



Leucospermum lineare



Common names: Needle-leaf Pincushion, Assegaaibosspeldekussing (A)

Height: 1–2 m Spread: 1–3 m

Flowering time: July to January, with a peak from September to October

An erect or sprawling, neat shrub with distinctive linear leaves, this species is restricted to granitic clay slopes in the Bainskloof, Hottentots Holland, Paarl, Franschhoek and Villiersdorp mountain ranges. It is threatened by habitat loss due to farming and forestry.

As a horticultural subject it is outstanding for its vigour, long stems and long-lasting flower heads, its adaptability to a variety of well-drained, acid soils, drought tolerance once well established and resistance to moderate frost. The deep orange form is the most well known and has erect stems, whereas the yellow form has a sprawling habit. Regular pruning after flowering will produce bushy new growth and lengthen the life of the plants. *L. lineare* is well suited to rock garden pockets and mixed fynbos plantings and the yellow form can be maintained in deep containers, with careful pruning.

Propagation is from seed or cuttings.

Left: *Leucospermum lineare*

Opposite: *Leucospermum hypophyllocarpodendron* subsp. *hypophyllocarpodendron*

Leucospermum muirii



Common names: Albertinia Pincushion, Bloukoolhout (A)

Height: 1–1.5 m Spread: 0.8–1 m

Flowering time: July to October

This tidy, rounded shrub is confined to a small coastal area of the southern Cape from Stilbaai to the Gourits River mouth east of Albertinia, growing in deep white, acid sand. It is endangered due to agricultural expansion and invasive alien plants.

The narrow, dark green foliage contrasts effectively with the reddish stems and showy, small, yellow flower heads that mature to orange. It is easily cultivated and highly recommended as a low-growing shrub for small fynbos gardens, rock garden pockets and large, deep containers. It adapts well to granitic soils and needs good drainage and



full sun. The plants are long-lived in cultivation and respond well to light pruning after flowering to maintain a bushy shape. The cut stems are suitable for small arrangements.

Propagation is from seed or cuttings.

Leucospermum mundii



Common name: Langeberg Pincushion

Height: 0.5–1 m Spread: 1–2 m

Flowering time: July to November

A spreading low shrub from the Langeberg between Swellendam and Riversdale, this species occurs on dry sandstone slopes, growing in small isolated populations.

Below left: *Leucospermum muirii*

Below: *Leucospermum mundii*

Opposite: *Leucospermum oleifolium*





Its distinctive wedge-shaped leaves have up to 17 apical teeth and the flower heads are carried in clusters; they are at first yellow, becoming deep orange as they mature, producing an attractive bicoloured display. This is an ideal plant for rock garden pockets or placed towards the front of mixed fynbos plantings, and can also be grown in large, deep containers. It needs an acid, sandy or granitic soil and light pruning after flowering to maintain a compact shape. It is highly attractive to honeybees.

Propagation is best from cuttings.

Leucospermum oleifolium



Common name: Overberg Pincushion

Height: 0.7–1 m Spread: 1–2.5 m

Flowering time: August to January, with a peak from September to October



This most attractive compact, rounded shrub is native to sandstone flats and mountain slopes from Kleinmond in the southern Cape to the Slanghoek Mountains near Rawsonville in the south-western Cape.

The plants have greenish grey, smooth or hairy foliage and flower head clusters which are at first yellow, becoming deep orange-red with age; they adorn the bushes for about two months and collectively the various forms bloom from early spring to midsummer.

This long-lived species cannot be recommended highly enough for cultivation, whether as a subject for mass planting, as a specimen plant for small gardens, in mixed fynbos rock gardens or even as a container plant. It is well suited to windy seaside conditions, adapts readily to granitic soils, attracts beneficial insects and is a good cut flower.

Propagation is from seed and cuttings.



Leucospermum patersonii



Common names: Silver-edge Pincushion, Basterkreupelhout (A)

Height: 3–4m Spread: 2–3m

Flowering time: August to December

Forming a very large shrub or small tree, this robust plant is endemic to limestone deposits along a small area of the southern Cape coastline from Kleinmond to Cape Agulhas. Its populations are vulnerable to urban and agricultural expansion.

This long-lived species has broad, oblong leaves with heavily toothed upper margins covering the stems which terminate in large deep orange or crimson flower heads. Although confined to alkaline media in the wild, it adapts to granitic, acid soils in cultivation.

This is a species for mixed plantings in large fynbos gardens, or as a specimen feature. It is wind tolerant, waterwise and highly attractive to nectar-feeding birds. It makes a fine cut flower.

Propagation is from seed and cuttings.

Leucospermum praecox



Common name: Mossel Bay Pincushion, Rooivlamspeldekussing (A)

Height: 2–3 m Spread: 2–4 m

Flowering time: April to September

Occurring on acid sandy flats in the southern Cape from the Gourits River Mouth to Mossel Bay, this large rounded shrub is locally

abundant over large areas, creating superb floral displays. Unfortunately its numbers are threatened by agricultural expansion.

A superb garden plant, it commences flowering early in the season, as its specific name suggests, in autumn, but the flowering period is long, extending throughout winter to mid-spring. The smooth, light green leaves have five to 11 apical teeth and the medium-sized yellow flower heads turn to bright orange when mature. It is recommended for small to large gardens with well-drained, acid or slightly alkaline soils in full sun. It is a good cut flower and highly prized by nectar-feeding birds.

Propagation is best from cuttings.

Below: *Leucospermum praecox*

Opposite left: *Leucospermum patersonii*

Opposite right: *Leucospermum praecox*



Leucospermum prostratum



Common names: Yellow Trailing Pincushion, Geelrankspeldekussing (A)

Height: 0.2–0.35 m Spread: 2–4 m

Flowering time: July to December

A prostrate or low mound-forming shrublet from sandy flats and lower mountain slopes from the Groenlandberg near Grabouw and Kogelberg, along the coast to Hermanus and the Elim flats in the southern Cape, where it is vulnerable to urban expansion.

The plant produces numerous short, sub-erect as well as long trailing stems from a fire-resistant rootstock and becomes covered with beautiful small, bright yellow, scented flower heads that mature to orange.

This is a species for the specialist collector and performs best in very well-drained, sandstone-

derived soils. It is waterwise once established and recommended for planting in fynbos rock garden pockets, cascading over low retaining walls or as a subject for deep pots.

Propagation is from seed or cuttings.

Leucospermum reflexum var. *reflexum*



Common names: Rocket Pincushion, Perdekop (A)

Height: 3–4 m Spread: 2–3 m

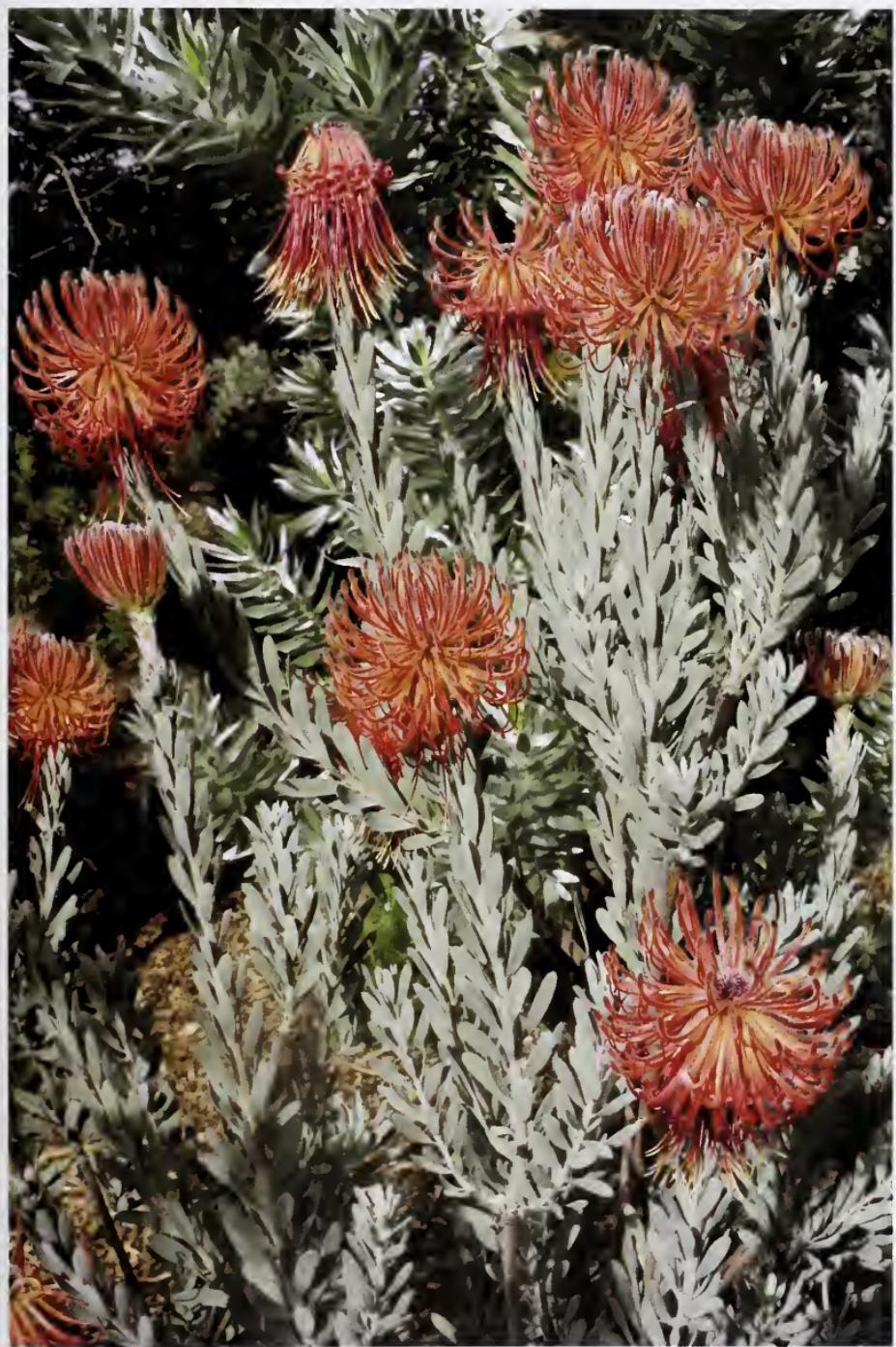
Flowering time: August to December

A fairly long-lived, large, rounded shrub with silvery grey foliage, *L. reflexum* is native to sandstone slopes of the Cederberg from the Pakhuis Pass to Wupperthal, and comprises two varieties, var. *reflexum* and var. *luteum*.

Below: *Leucospermum prostratum*

Opposite: *Leucospermum reflexum* var. *reflexum*





In var. *reflexum*, the distinctive rocket-like flower heads with the styles sharply bent backwards and downwards, are light to deep orange or scarlet. Its striking grey foliage provides excellent contrast against green-leaved plants. This superb, fast-growing and vigorous garden subject is suited to medium-sized and large gardens with deep acid, sandy or granitic soils in full sun. It is best planted in groups to provide mutual support to prevent shrubs from falling over in strong wind. The shrubs tend to flower so prolifically that after a few years they are no longer able to sustain themselves, thus regular pruning (within the leaf zone) for cut flowers assists in encouraging new shoots. It is fairly waterwise once established, makes a good cut flower and is highly prized by nectar-feeding birds.

Propagation is from seed or cuttings.

Below: *Leucospermum rodolentum*

Opposite: *Leucospermum tottum* var. *tottum*



Leucospermum reflexum var. *luteum*



Common names: Yellow Rocket Pincushion, Geel Perdekop (A)

Height: 3–4 m Spread: 2–3 m

Flowering time: August to December

This outstanding, clear yellow form is confined to a single population at Heuningvlei in the Cederberg Mountains.

Like the orange and scarlet forms, it is an excellent strong-growing subject for medium-sized and large gardens, and is most effectively displayed when inter-planted with the orange and scarlet forms. It is fairly long-lived and requires the same growing conditions as var. *reflexum*. It has a good vase life and attracts nectar-feeding birds.

Propagation is from seed or cuttings.

Leucospermum rodolentum



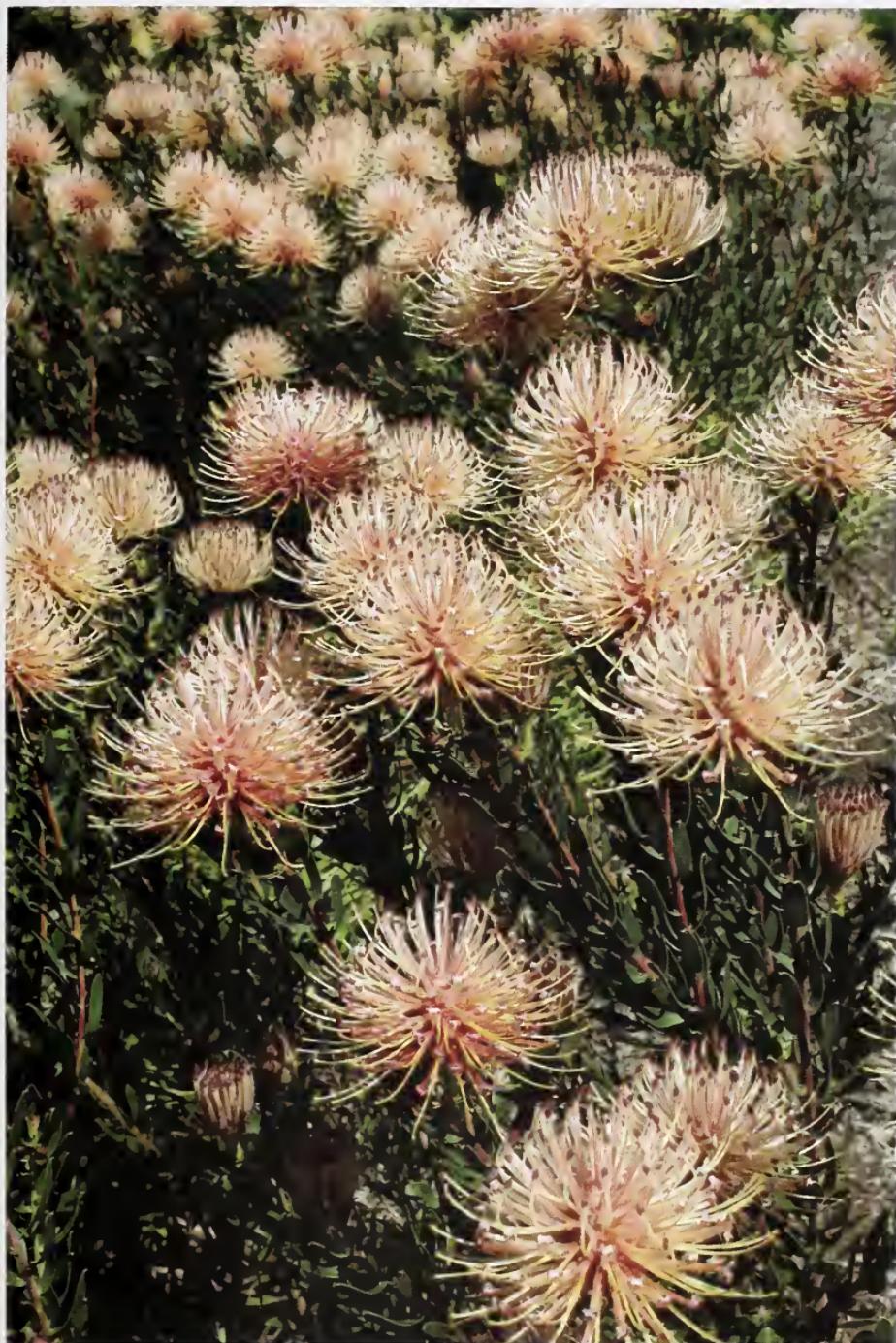
Common names: Sandveld Pincushion, Sandveldluisiesbos

Height: 1–3 m Spread: 2–4 m

Flowering time: August to November

This tall, spreading, intensely glaucous-leaved shrub occurs on dry, sandy flats in south-western Namaqualand, along the Cape West Coast to Hopefield, on the Cape Flats and in the Breede River Valley. Its populations are vulnerable to agricultural expansion and groundwater extraction.

The sturdy stems bear small scented yellow flower heads and the plant is an outstanding choice for windy coastal gardens in full sun. Once established, the bushes are long-lived and very waterwise, performing well in deep,



acid, sandy soils and readily adapting to granitic media. The flower heads are highly attractive to honeybees and other insects.

Propagation is best from cuttings.

Leucospermum tottum var. tottum



Common names: Ribbon Pincushion, Oranjerooispeldekussing (A)

Height: 1–1.5 m Spread: 1–2 m

Flowering time: September to January

This very floriferous and neat, mound-forming shrub occurs on rocky sandstone slopes from the Cederberg to the Du Toits Kloof Mountains and there are two varieties, var. *tottum* and var. *glabrum*.

In var. *tottum* the reddish, hairy, horizontally spreading branches usually produce a single large, light to deep pink or salmon-coloured, somewhat laterally flattened flower head. This is a fast-growing plant and one of the most outstanding pincushions for cultivation, ideal for mass planting in wide borders, rock gardens, grown as a specimen feature or even in deep containers. They are ideal for mixed plantings with other spring-flowering fynbos shrubs like *Leucadendron discolor* and *Phyllica plumosa*, and the groundcover *Syncarpha argyropsis*. The bushes flower so prolifically that regular pruning for cut flowers is necessary to prolong the life of the plants. This is a waterwise species once established and is highly attractive to nectar-feeding birds like sunbirds and the Cape sugarbird.

Propagation is from seed or cuttings.

Right: *Leucospermum tottum var. tottum*

Opposite: *Leucospermum formosum* is an ideal choice for the mixed fynbos garden and its nectar is highly prized by sunbirds.

Leucospermum tottum var. glabrum



Common name: Worcester Ribbon Pincushion

Height: 1–1.5 m Spread: 1–2 m

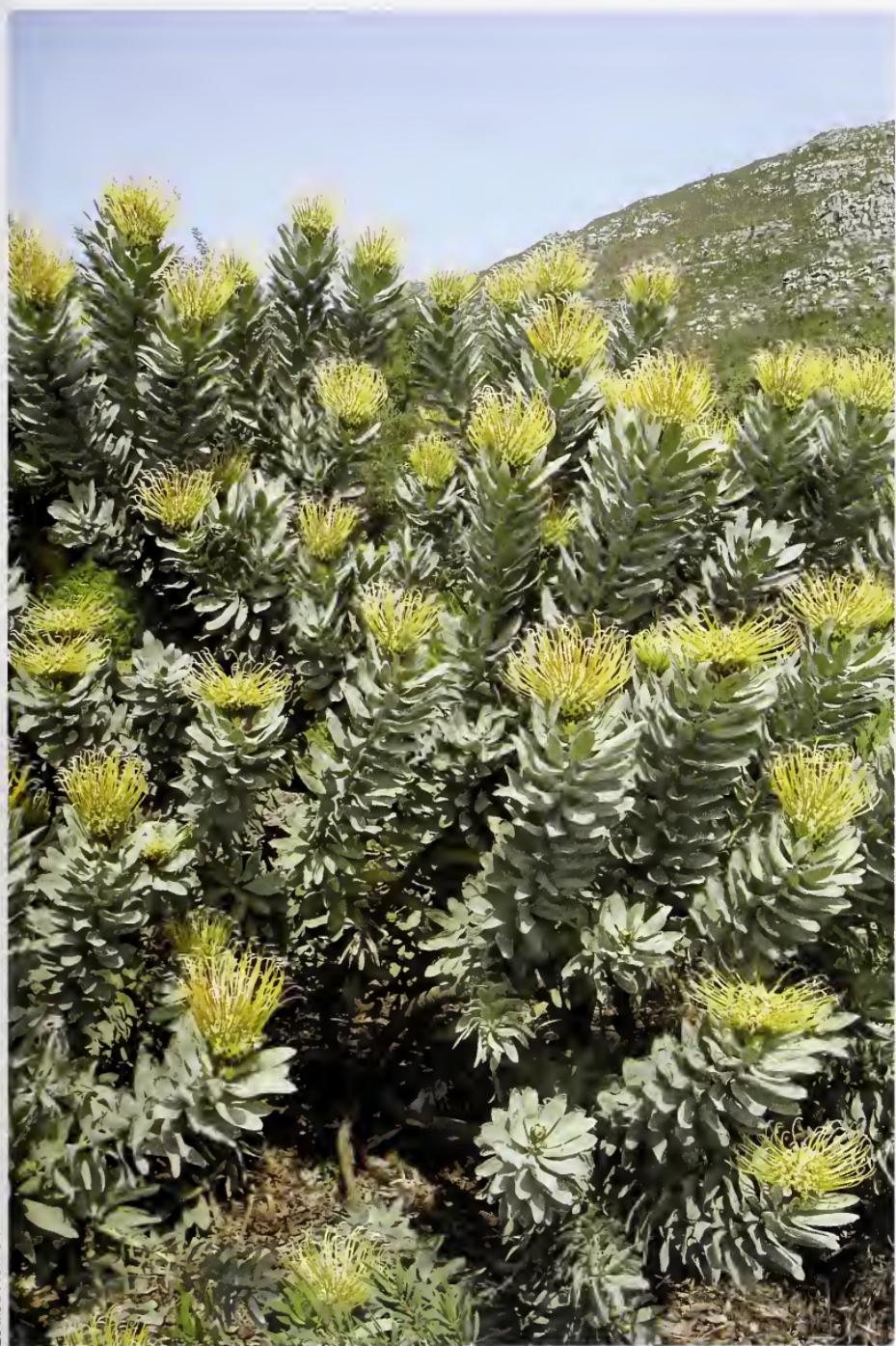
Flowering time: October to December

This variety occurs in just a few populations on sandstone slopes of the western Hex River Mountains in the south-western Cape, and is critically endangered due to alien plant invasion.

It differs from var. *tottum* mainly in its erect flowers with orange styles and red pollen presenters, and in its smooth stems. The plant has potential as a landscape or specimen plant but is currently very rare in cultivation.

Propagation is from seed or cuttings.







Leucadendron (Conebushes)

A large genus comprising 83 species of small to large shrubs or trees, *Leucadendron* is distributed from the north-western Cape to the Cape Peninsula and eastwards to southern KwaZulu-Natal, and has its greatest diversity in the south-western and southern Cape (Williams 1972). The genus name is derived from the Greek words *leucos* (white) and *dendron* (tree) with respect to the Silver Tree *Leucadendron argenteum*, on which the genus is based.

Like *Aulax*, *Leucadendron* is dioecious or unisexual, and male and female reproductive organs are produced on separate plants. The flower heads of female plants form old woody cones containing the fruits, whereas those of the males are smaller, much softer and ephemeral. During the flowering period, the involucral bracts encircling the flower heads of many species transform to shades of bright yellow, cream or red. The flower heads are pollinated mainly by small beetles including monkey beetles, and ten of the species are the only wind-pollinated members of the Proteaceae in southern Africa (Rebelo 2001). Seed shape varies in two main groups, those with rounded, nut-like seeds and those with flat seeds. The seeds of most species remain stored in woody cones for a year or more and in *L. argenteum* they are equipped with a 'parachute', made up of the persisting style and the plumed perianth, which aids dispersal by wind. In the remaining species the seeds are released from the cones within a few months of flowering. Many *Leucadendron* species are threatened in the wild (Rebelo *et al.* 2006, see <http://redlist.sanbi.org>).

Below: *Leucadendron argenteum* (male)

Opposite: *Leucadendron salignum* 'Blush'
(female)



Leucadendron salignum is the most variable species, with the widest distribution, and it has a persistent subterranean rootstock which resprouts after fires. Most conebrushes are killed by fire and survive in seed form within tough, woody cones until suitable conditions prevail for germination, such as those of *L. spissifolium*, which are released after fire.

Cultivation

All conebrushes require full sun and most need well-drained, nutrient-poor, acid soils, however they are often easier to grow than proteas and pincushions because they are tolerant of a wider range of soil types including slightly alkaline media, and others can be grown in clay (see page 18). They are wind-resistant and drought-tolerant once fully established and the larger species make excellent screens, windbreaks and specimen trees. The smaller conebrushes are outstanding subjects for rock garden pockets and mixed fynbos beds, and some can even be grown successfully in deep containers.

Their cut stems are excellent 'filler' material for flower arrangements and the flower heads of certain species are scented and attract beneficial insects like honeybees and butterflies, which in turn attract insect-eating birds. Most seed-grown conebrushes are best planted in small groups of five to seven plants to ensure that both males and females are present and that seed will be produced. During the juvenile stage the frost tolerance of *Leucadendron* varies from tender to slightly hardy, but improves markedly once fully established, varying from slightly to strongly hardy, depending on the species.

Propagation

Leucadendron species are best propagated from seed and certain fast-growing ones like *L. eucalyptifolium*, *L. laureolum* and *L. salignum* can flower in their second year in

ideal conditions. For preservation of genetic features, propagation from cuttings is the only way of ensuring progeny will be male or female, or that particular genetic traits will be preserved.

For seed propagation, a day-night temperature difference of about 15°C in autumn, with a night temperature of 10°C or lower, triggers germination in many species and seeds are best sown from early to mid-autumn (March to April). Dust seeds with a systemic fungicide containing the active ingredient metalaxyl and sow in seed trays placed in a sunny position in a well-drained, sterile medium such as 8 parts finely milled pine bark and 3 parts coarse sand. To obtain the optimum pH of 4.5–5.5, lime should be added to very acid media. Cover the seeds with a thin layer of coarse sand or finely milled bark and keep moist but not wet. Applying a smoke treatment (see page 33) will improve germination in many species although in *L. discolor* it is unnecessary (Nurriish 2012a). Germination periods vary markedly amongst the species, for example seeds of *L. discolor* germinate in 2–3 weeks whereas those of *L. argenteum* germinate erratically over several months and *L. sessile* and *L. tinctum* may only germinate a year after sowing. Germination in *L. argenteum* can be improved by soaking seeds in a mixture of diluted hydrogen peroxide and smoke water for 24 hours, then rinsing off with fresh water and placing in damp peat in plastic bags. During the day, the bags are left open at room temperature to 'breathe', and at night, stored in a fridge; after three weeks, fresh seeds should start germinating and can then be planted into seed trays and grown-on (Nurriish 2013b).

Species with fine leaf hairs like *L. rubrum* are more difficult to grow from seed as the hairs trap water which encourages fungal attack, and for these a not-too-moist propagation

medium and frequent fungicidal treatment are required (Nurriish 2010a). Once the first two true leaves have appeared, the seedlings are ready to be pricked out into small nursery bags and placed in a lightly shaded area with good air circulation. Once seedlings have grown to 50–100 mm high, they are ready to be planted out.

Semi-hardwood cuttings 60–100 mm long from current season's growth are taken from midsummer to early autumn (December to March). Remove the leaves from the basal third of the cutting and dip them into a rooting hormone solution or hormone powder and insert into multitrays in a well-drained rooting medium such as 50% finely milled pine bark and 50% polystyrene balls, and place in a growing house with 25°C bottom heat and intermittent mist. Once strong rooting has taken place, remove trays from bottom heat and harden-off for three weeks, then grow-on for about a year until plants are ready for planting out.

Pests and diseases

Conebushes with hard, linear leaves like *L. galpinii* and *L. nobile* suffer very little damage from insect pests but many species are susceptible to leafworm and snout beetle damage, but usually not seriously enough to warrant intervention. Leaf spots and 'leaf drop' due to fungal infections are much more serious conditions and may require treatment in severe outbreaks (see page 65). A number of conebushes including *L. discolor*, *L. galpinii*, *L. salignum* and *L. tinctum* are fairly resistant to *Phytophthora* but the roots of several species, in particular *L. argenteum*, are highly susceptible to it (see page 66). Preventative measures are best implemented to reduce fungal attack including planting in well ventilated areas in full sun, watering in

the morning, keeping the soil cool and weed-free by mulching, not disturbing the soil, removing diseased plants immediately, not over-watering in summer and pruning away and destroying diseased material.

Below: *Leucadendron salignum* 'Red Button' (male)



Recommended *Leucadendron* species

(For an explanation of cultivation symbols and hardiness ratings see page 17).

Leucadendron argenteum



Common names: Silver Tree, Silwerboom (A), Witteboom (A)

Height: 7–10 m Spread: 1.5–2.5 m

Flowering time: September

The shimmering Silver Tree is endemic to south- and east-facing mountain slopes of the Cape Peninsula. The populations east of Cape Town on the Helderberg, Paarlberg, Riebeek Kasteel Mountain, Simonsberg and Tygerberg may have been planted. The species is endangered as a result of habitat loss and smothering invasive alien plants.

This fast-growing, upright tree with its pleasing layered form has a stout trunk with thick corky bark and large light-reflecting, silvery grey leaves, the margins fringed with long silky hairs. The shimmering silvery effect of the leaves arises from the light reflected off the dense covering of fine silky hairs which lie flat against the surface in hot weather, but stand erect on cool days, giving it a greener appearance. The involucral bracts are silvery cream; the male flower heads are soft balls of light pink and yellow whereas those of the female are produced between silvery bracts and develop into silver cones. The plants require granitic soil and do not perform well in sandstone media. They are exceptionally attractive subjects for cultivation, suited to group planting in large fynbos gardens, as specimen trees in small or medium-sized gardens, or even grown in large containers. Once established they are drought tolerant in summer and wind resistant. The decorative foliage is useful as 'filler' material in mixed



flower arrangements. Unfortunately the trees generally only live for about 20 years.

Propagation is best from seed, but germination is erratic (see page 34). Silver Trees are highly susceptible to *Phytophthora* and to fungus-induced leaf-drop in the lower portion of the branches (see pages 65-66).

Leucadendron daphnoides



Common names: Du Toits Kloof Conebush, Reusepoeierkwas (A)

Height: 1–1.5 m Spread: 1–2 m

Flowering time: July to September

This erect small shrub has a limited distribution on granitic mountain slopes in the south-western Cape from Du Toits Kloof to Villiersdorp, and is endangered due to habitat loss from afforestation and expanding agriculture.



The involucral leaves surrounding the showy flower heads turn bright ivory or yellow, then red during the flowering period, and the flowers of both the male and female plants have a citrus-like scent. This is an easily cultivated plant with a sturdy, neat habit. It is fairly long-lived and can be grown in well-drained, acid, sandstone-derived or granitic soils. It is recommended for small fynbos gardens and rock garden pockets in full sun. Pruning is essential to prolong the life of the plant and maintain a bushy shape. It is wind tolerant, makes a good cut flower and is waterwise once established.

Propagation is from seed or cuttings.

Leucadendron discolor



Common names: Piketberg Conebush, Rooi-Tolbos (A)

Height: 1.8–4 m Spread: 0.8–1.2 m

Flowering time: August to September

Confined to rocky sandstone slopes in the Piketberg mountains of the Western Cape, this erect bushy shrub is vulnerable to habitat loss from agriculture.

The leathery, greenish grey, oval involucral leaves turn bright creamy white in spring and the male flower heads are exceptionally attractive when the bright red or yellow flower buds start opening, creating a striking colour contrast. The plants respond very well to cultivation and require a hot, sunny position.

Left: *Leucadendron discolor* (male)

Opposite left: *Leucadendron argenteum* (male)

Opposite right: *Leucadendron daphnoides* (male)

They adapt well to a wide range of soil types including granitic media, as long as drainage is good.

The male inflorescences make outstanding cut flowers with long, sturdy stems and the male selection 'Pom-pom' is especially desirable with intensely red flower buds. Flowering stems should be pruned back hard within the leaf zone to encourage bushy new growth. The plants are drought tolerant once established.

Propagation is from seed or cuttings.

Below left: *Leucadendron discolor* 'Pom-pom' (male)

Below right: *Leucadendron eucalyptifolium* (male)

Opposite left: *Leucadendron floridum* (male)

Opposite right: *Leucadendron galpinii* (female)

Leucadendron eucalyptifolium



Common names: Gum-leaf Conebush, Grootgeelbos (A)

Height: 3–5 m Spread: 2–3 m

Flowering time: July to October

A robust shrub or small tree from the southern Cape, this species occurs from the Waboomsberg and Potberg to the Van Staden's Mountains near Port Elizabeth.

The linear, eucalyptus-like leaves surrounding the flower heads turn bright yellow in both male and female plants and this species has a long flowering period from midwinter to late spring. The male flower heads are slightly larger than those of the females, and the latter have a fruity scent. This is a fast-growing, long-lived plant that is waterwise. It requires acid, well-drained soil in full sun and is recommended for large fynbos gardens and can be grown as a specimen plant or in



informal hedges or windbreaks. It is useful as 'filler' material in flower arrangements.

Propagation is from seed or cuttings.

Leucadendron floridum



Common name: Flats Conebush

Height: 1–2 m Spread: 0.5–2 m

Flowering time: September to October

This critically endangered cone bush is now confined to a couple of moist sites in the southern Cape Peninsula and near Kuils River on the Cape Flats. It is critically endangered due to urban expansion and invasive alien plant infestation.

Both male and female plants have willowy, slender branches and very attractive silvery leaves with larger, yellow involucral leaves. In cultivation the plants perform well in moist, sandstone-derived soils and can be grown in association with other moisture-loving species such as *Mimetes hirtus* and



Leucadendron laxum. It can also be cultivated in deep containers provided it is pruned regularly to ensure a bushy shape. The cut stems of male plants provide excellent 'filler' material in flower arrangements.

Propagation is from seed or cuttings.

Leucadendron galpinii



Common names: Hairless Conebush,
Droëvlakketolbos (A)

Height: 1.5–3 m Spread: 0.8–1.2 m

Flowering time: October to January

A robust, elegant shrub from the southern Cape, *L. galpinii* grows on sandy coastal flats from De Hoop Nature Reserve to Mossel Bay and is vulnerable to alien plant invasion.

This species has silvery linear leaves and the flower heads emit a yeasty scent. It grows naturally in neutral soils but readily adapts to acid granitic media. This is a good subject for



rock garden pockets, windy coastal gardens and mixed fynbos plantings, or grown as an informal hedge, screen or windbreak. The overall silvery grey appearance of the shrubs provides excellent contrast in the garden. The striking silvery grey cones produced by the females mature towards the end of the year, are very long-lasting and make excellent subjects for mixed flower arrangements. This is a robust, long-lived and waterwise plant once fully established in the garden. The leaves of female plants of the cultivar 'Purple Haze' turn purplish in winter.

Propagation is from seed or cuttings.

Leucadendron gandogeri



Common names: Broad-leaf Conebush, Berggeelbos (A)

Height: 1–1.6 m Spread: 1–1.5 m

Flowering time: August to September

This attractive rounded shrub occurs on rocky sandstone slopes from the Hottentots Holland Mountains to Bredasdorp in the southern Cape.

The plants have reddish stems and the involucral leaves turn brilliant yellow in early spring and are sometimes flushed with orange-red.

The female flower heads are larger than those of the males and clear yellow, and those of the male are lemon-scented. This is an easily cultivated, long-lived plant and recommended for small fynbos gardens with well-drained, sandstone-derived or granitic acid soils in full sun. Both female and male plants produce excellent cut flowers and plants can be grown in deep containers, with careful pruning.

Propagation is from seed or cuttings.

Below: *Leucadendron gandogeri* (male)

Opposite left: *Leucadendron laureolum* (female)

Opposite right: *Leucadendron laxum* (male)



Leucadendron laureolum



Common names: Golden Conebush,
Louriertolbos (A)

Height: 1.5–2 m Spread: 1–2.5 m

Flowering time: May to July

Occurring in dense stands in the southern Cape Peninsula, on Paarl Mountain and to the north-east on the Potberg in the southern Cape, this is a shrub that occurs in a great range of soils in its natural habitat, including acid sands, granite and limestone, from sea level to 1000 m.

Male shrubs are rounded in appearance whereas female plants are less symmetrical. The bright yellow involucral leaves partially conceal the flower heads in males and totally conceal those of the females. Both males and females produce dazzling autumn and winter floral foliage and provide very good



cut flower stems. This is an outstanding long-lived, moderately fast-growing shrub for the garden, performing well in acid sandy, granitic or clay soils in full sun. It is wind-tolerant and waterwise once fully established.

Propagation is from seed or cuttings.

Leucadendron laxum



Common names: Bredasdorp Conebush,
Vleirosie (A)

Height: 1.5–1.75 m Spread: 0.5–1 m

Flowering time: September to October

This beautiful slender, fine-leaved shrub occurs on perennially moist, acid sandy-gravel flats from Hermanus to Cape Agulhas and is endangered due to agricultural expansion.

The solitary erect trunk produces long, narrow branches which have numerous short branchlets bearing small pom-pom-like



flower heads. The male and female plants have bright yellow flower heads and both are most desirable for cultivation and as cut flowers. The plant adapts well to granitic soils and is recommended for small gardens and mixed fynbos plantings, such as with *Leucadendron tinctum* and *Phyllica plumosa*. *L. laxum* likes a perennially moist position in the garden or one that is watered regularly.

Propagation is by seed and cuttings.

Leucadendron macowanii



Common name: Acacia-leaf Conebush

Height: 2–2.5 m Spread: 0.8–1.2 m

Flowering time: May to July

An attractive erect, fast-growing shrub with willowy, yellowish green foliage, this species is endemic to acid sandstone-derived soils along streams in the southern Cape Peninsula. It is

critically endangered due to habitat loss and alien plant invasion, amongst other threats.

Unusually, the male and female flower heads bloom without involucral leaves. Both male and female plants are recommended for cultivation, the males having dense clusters of bright yellow flower heads and those of the females forming attractive dark brownish maroon cones in late summer. In cultivation this species adapts well to granitic soils and is a long-lived, easily grown plant for permanently moist parts of the garden in full sun. It is best planted in small groups. The female cut stems are useful as 'filler' material in flower arrangements.

Propagation is best from seed.

Below left: *Leucadendron macowanii* (male)

Below right: *Leucadendron nobile* (female)

Opposite left: *Leucadendron rubrum* (female)

Opposite right: *Leucadendron rubrum* ripe flower head (female).



Leucadendron nobile



Common names: Karoo Conebush,
Naaldblaartbos (A)

Height: 2–4 m Spread: 1–2 m

Flowering time: October to March, with a peak
in December

A robust, large or medium-sized, tall shrub
from the Western and Eastern Cape, this
unusual conebush occurs in gravelly quartzite
on slopes of the Kouga, Baviaanskloof and
Willowmore Mountains.

The plant has an upright, erect habit and the
stems have a dense covering of needle-like
leaves. Female plants are best for cultivation
with their large, elongated green cones, from
which the seeds are released after a number
of years. This is an excellent, long-lived
landscape plant, performing well in a range of
well-drained, acid soils in full sun. It is drought

tolerant once established, and with pruning it
makes a striking subject for deep containers.

Propagation is best from seed.

Leucadendron rubrum



Common names: Spinning Top Conebush,
Tolletjiesbos (A)

Height: 1.5–2.5 m Spread: 1–2 m

Flowering time: August to September

This erect, multi-branched shrub has a wide
distribution from the Bokkeveld Mountains in
the Northern Cape to the Baviaanskloof in the
southern Cape.

The branches are densely covered with
narrow, silvery-grey leaves which are softly
hairy when young. The curious spinning
top-like female cones are tightly covered with
prominent silvery grey bracts marked with
yellow and deep reddish brown.



Generally long-lived in cultivation, the plants are very waterwise once established; they are well suited to hot and dry fynbos gardens and grow well in sandstone and granitic soils. Cut stems carrying closed female cones make an interesting addition to fynbos arrangements, as do open female cones in dried flower arrangements.

Propagation is from seed or cuttings, but both methods are problematic as the fine leaf hairs trap excessive moisture, causing fungal growth.

Leucadendron salignum



Common names: Common Sunshine Conebush, Knoppiesgeelbos (A)

Height: 0.5–2 m Spread: 0.5–2 m

Flowering time: April to December

This highly variable species has the widest distribution of all the cone bushes, occurring from the Bokkeveld Mountains to the Cape Peninsula and east to Port Elizabeth.



Above: *Leucadendron salignum* 'Blush'
(female)

Below left: *Leucadendron salignum* 'Red Button' (male)

Below right: *Leucadendron salignum* (male)
Opposite: *Leucadendron sessile* (male)



It forms an erect or spreading, multi-stemmed shrub and has a persistent rootstock. The involucral leaves of male plants are similar in shape to the stem leaves but longer, and red or yellow, and do not obscure the flower heads, whereas in female plants they are much broader and enclose the flower head, and are usually ivory-coloured. This is a highly recommended plant for acid, sandstone or granitic soils in small fynbos gardens, rock garden pockets and large, deep containers. It is highly recommended as 'filler' material in flower arrangements.

Numerous cultivars are available in the trade including 'Blush' which is an outstanding, hardy garden shrub and recommended for its bright red new foliage and stems, of which female plants have especially bright red involucral bracts from March to May. The male cultivar 'Red Button' is especially attractive with its bright red centres, yellow involucral leaves and red stems. The low-growing, red-and-yellow cultivar 'Candles' reaches up to 1m and is ideal for rock garden pockets and containers, and can take moderately heavy



soils and moderate frost, flowering in August and September.

The yellow cultivar 'Yellow Devil' grows to 1 m and is bright yellow in July and August and recommended for small gardens, containers and rock garden pockets, but is only slightly hardy. 'Red Devil' is another relatively small cultivar up to 1 m high with bright red leaves in autumn. It has moderate frost tolerance and moderate tolerance of heavier soils.

Propagation is equally successful from seed or cuttings.

Leucadendron sessile



Common names: Western Sunbush, Kleinkoprosettolbos (A)

Height: 1–1.5 m Spread: 1–1.5 m

Flowering time: July to August

This strong-growing and colourful rounded shrub occurs on granitic clay mountain slopes at Ceres, Tulbagh, Worcester and Stellenbosch, and from the Hottentots Holland Mountains to Cape Hangklip.

The involucral leaves of both sexes turn bright yellow in winter and early spring, and redden with age. Those of the showy male flower heads are much larger than the females and are strongly lemon-scented. This is an easily cultivated, long-lived garden plant, suited to granitic clay or sandy well drained soils, provided it has plenty of moisture in winter and the roots are kept cool in summer with generous mulching. The plants are wind tolerant and suited to coastal gardens.

Because the stems are fairly short, this species is not grown for the cut flower trade. The flower heads are highly attractive to insects, especially beetles and honeybees.

Propagation is from seed or cuttings.

Leucadendron spissifolium* subsp. *spissifolium



Common name: Common Spear-leaf Conebush

Height 1–1.3 m Spread: 1–2 m

Flowering time: August to October

Forming small, densely-branched shrubs with persistent rootstocks, *L. spissifolium* is widely distributed from the Gifberg south of Vanrhynsdorp to southern KwaZulu-Natal and its various geographical variants comprise five subspecies. The subsp. *spissifolium* is native to south-facing sandstone slopes from the Gifberg to the Anysberg in the southern Cape.

This fast-growing, long-lived plant produces striking ivory-white or light green involucral leaves and yellow flowers, and both male and female flower heads are lemon-scented. The female plants produce reddish cones which remain on the bushes for extended periods, releasing their seeds directly after wild fires.

This is an easily cultivated leucadendron, performing well in both sandstone and granitic media, and is recommended for mixed fynbos beds. Both male and female flower heads are attractive as 'filler' material for the vase and the dried cones of the female are useful additions for dried flower arrangements.

Propagation is by seed and cuttings.

Leucadendron spissifolium* subsp. *fragrans



Common name: Fragrant Spear-leaf Conebush

Height 1–1.3 m Spread: 1–2 m

Flowering time: September to November

The subsp. *fragrans* is locally common on upper south-facing slopes of the Langeberg, Outeniqua, Kammanassie and Swartberg Mountains in the southern Cape. Like subsp. *spissifolium*, it forms a low, densely-branched shrub and has a persistent rootstock that resprouts after fire.



Like subsp. *spissifolium*, the flower heads are lemon-scented. The plants differ minimally from subsp. *spissifolium* in their shorter and narrower, somewhat more twisted leaves, the involucral leaves enclose the flower heads more closely and flowering commences a month later. The plants are long-lived and relatively resistant to *Phytophthora*, perform well in sandstone and granitic media and are ideal for mixed fynbos gardens. The bright green flowering cones of female bushes provide striking contrast against the ivory-white involucral leaves and their long-lasting cut stems are excellent 'filler' material for mixed arrangements.

Propagation is by seed and cuttings.

Leucadendron stelligerum



Common name: Agulhas Conebush

Height: 0.5–1.3 m Spread: 0.5–1 m

Flowering time: July to August

A very elegant species, *L. stelligerum* is confined to coastal flats west of Cape Agulhas in gravel, ferricrete and clay, and is critically endangered due to crop cultivation and road verge clearing.

The shrubs have long, thin, reddish branches arising from a single stem and bear small flower heads which have a star-like appearance due to the many bright yellow or red-tipped, spreading involucral bracts, which end in sharp points. Performing well in

Right: *Leucadendron strobilinum* (male)

Opposite left: *Leucadendron spissifolium* subsp. *fragrans* (female)

Opposite right: *Leucadendron stelligerum* (male)

cultivation, the plants easily adapt to granitic soils, and are recommended for rock garden pockets or the centre of wide borders. They are waterwise once established and cut stems are attractive for the vase. The dwarf cultivar 'Harvest' is suitable for growing in deep pots. Propagation is from seed or cuttings.

Leucadendron strobilinum



Common names: Peninsula Conebush, Rotstolbos (A)

Height: 1.2–2.6 m Spread: 1–2 m

Flowering time: September to October

This beautiful long-lived, but slow-growing shrub is endemic to the Cape Peninsula, occurring on rocky sandstone slopes from Table Mountain to Kommetjie.

The sturdy reddish stems arise near the base of the plant and the dark green new leaves have hairy margins tinged with red when young. Involucral bracts in both male and female plants turn greenish yellow or bright yellow in



Alice Notten

spring and have minute red tips. *L. strobilinum* performs equally well in sandstone and granitic soils and is ideal for mixed fynbos plantings and large rock gardens. The plants are waterwise once established and cut stems are useful as 'filler' material in flower arrangements.

Propagation is from seed or cuttings.

Leucadendron tinctum



Common names: Spicy Conebush, Toffie-appel (A)

Height: 1–1.3 m Spread: 0.8–1.2 m

Flowering time: May to July

An attractive, rounded, low bushy shrub with a fairly wide distribution on stony sandstone slopes from the Hex River Mountains to the Langeberg in the southern Cape.

This is one of the best conebrushes for cultivation. It has a compact habit with striking greenish grey, leathery leaves with rounded tips and no stalks. The involucral leaves are larger and yellowish green turning to red, and the female cones emit a strong spicy aroma. The



plants perform well in acid, sandstone-derived soils and adapt well to granitic media. An easily grown, long-lived species, it is ideally suited to small gardens and rock garden pockets, and is an ideal choice for mixed plantings with medium-sized restios, ericas and buchus.

Propagation is best from seed.

Leucadendron xanthoconus



Common names: Sickle-leaf Conebush, Blinkblaartolbos (A)

Height: 1–2 m Spread: 1–2 m

Flowering time: August to September

A robust, fast-growing plant from lower sandstone slopes and flats of the Cape Peninsula and from the Hottentots Holland Mountains to the Potberg in the southern Cape.

The silky new leaves are yellowish suffused with red, mature leaves have a silvery sheen and the involucral leaves are yellow, overtopping the flower heads. Both male and female plants are tough, drought- and wind-resistant shrubs once established, and are suited to large fynbos gardens in full sun. They perform well in sandy acid soils and easily adapt to granitic, well-drained media. They are useful in mid-layer planting or as informal hedges. The female cones with their good stem length make excellent long lasting 'filler' material in flower arrangements.

Propagation is from seed or cuttings, but easiest from seed.

Left: *Leucadendron xanthoconus* (female)

Opposite: *Leucadendron tinctum* (male) is easy to grow and ideal for small gardens, and its flower heads attract beneficial insects like honeybees.





Robbie Thomas

Mimetes (Pagoda bushes)

This handsome genus comprising 13 species of small to large shrubs, or rarely, trees, is endemic to the south-western and southern parts of the Western Cape (Rourke 1982, 1984). *Mimetes cucullatus* is the only species that is widely distributed within the Cape Floristic Region and most other members have highly restricted ranges. *Mimetes* stems have strongly overlapping, spreading to erect leaves with 1–3 glandular teeth. In leaf colour and texture the species can be placed in two groups, those with leathery green leaves and those with softer-textured silver or grey leaves. In all pagoda bushes the prominent cylindrical flower heads consist of flower clusters arranged near the ends of the branches in the axil of a subtending leaf. Depending on the species, the subtending leaves and involucral bracts may be enlarged or brightly coloured and almost all species are adapted to pollination by birds which feed on their plentiful nectar, with the exception of the sweet-scented *M. chrysanthus* which is probably pollinated by bees.

Mimetes cucullatus is the only species that regenerates after fires by means of a persistent subterranean lignotuber and all other species are killed by fire and survive in seed form. The nut-like seeds possess an elaiosome, an oily appendage that is consumed by ants. Indigenous ants relocate fallen *Mimetes* seeds to their underground nests where they are protected from rodents and germinate in favourable conditions (Bond *et al.* 1991). Almost all *Mimetes* species are threatened in the wild (Rebelo *et al.* 2006, see <http://redlist.sanbi.org>).

Cultivation

Easily cultivated *Mimetes* species like *M. chrysanthus*, *M. cucullatus* and *M. fimbriifolius* are suited to planting in mixed fynbos beds whereas the more difficult members like *M. argenteus*, *H. hottentoticus* and *M. splendidus* are best grown in deep containers or rock garden pockets, placed where their roots will not overheat on very hot days and receive a natural water supply not treated with chemicals. All species like a full sun position with excellent ventilation, and an acid soil without any compost. Their roots are highly sensitive to soil disturbance and like to be kept cool, thus an acid mulch of composted pine bark or pine needles is recommended. *Mimetes* attract sunbirds and sugarbirds to the garden and *M. chrysanthus* attracts many beneficial insects.

Propagation

Mimetes species are propagated from cuttings, by grafting and from seed. Unfortunately seeds are difficult to harvest and germination is often erratic, e.g. *M. cucullatus* has a 4–5% germination rate (Brown & Botha 2004) and does not respond to smoke treatment. Seeds are sown from early to mid-autumn (March to April) in seed trays in a well-drained, acid medium such as 8 parts finely milled pine bark and 3 parts coarse sand. To obtain the optimum pH of 4.5–5.5, lime should be added to very acid media. Cover the seeds with a thin layer of coarse sand or finely milled bark and keep warm and moist. Soaking the seeds in a 1% hydrogen peroxide solution for 24 hours before sowing will oxygenate the seeds by loosening the seed coat, which should be rubbed off. Dust, or water, the seeds with a fungicide containing the active ingredient metalaxyl to prevent fungal attack.

Germination takes 1–2 months and seedlings can be planted into small bags once their first

Opposite: *Mimetes argenteus*

set of true leaves has developed, then allowed to grow-on for about one year before planting out into the permanent containers.

Cuttings of species with green leaves like *M. cucullatus*, *M. fimbriifolius* and *M. hirtus* can be rooted and grown on their own roots, but those with silvery leaves like *M. arboreus*, *M. argenteus* and *M. splendidus* can be propagated more successfully by grafting onto rootstock of the genus *Leucospermum*, usually *L. conocarpodendron*, which is relatively resistant to *Phytophthora*. Cutting material which is young but not too soft is taken from branch tips or from side shoots taken as heel cuttings. Cuttings should be 100–120 mm long, of finger-thickness and kept cool after harvesting. They should be treated with a rooting hormone for semi-hardwood cuttings and placed in a moist rooting medium of equal parts of finely milled bark and polystyrene balls, in multitrays or pots in a well-aerated mist unit with bottom heat. Cuttings root well but slowly within six weeks to four months. Once rooted, harden them off for three weeks and plant into pots in a moist medium of equal parts of acidic river sand and composted pine bark or pine needles. For grafting information, see page 39.

Pests and diseases

The green-leaved species like *M. cucullatus* and *M. fimbriifolius* are subject to occasional leaf damage by caterpillars such as those of the Pine Emperor Moth (see page 60) but are relatively resistant to *Phytophthora*. The silver-leaved species are seldom subject to leaf damage but their roots are highly susceptible to *Phytophthora* (see page 66). Young plants of *M. chrysanthus* are susceptible to fungal tip die-back (see page 64) and mature bushes fall prey to *Phytophthora* if over-watered in summer (Hitchcock 2002).

Recommended *Mimetes* species

(For an explanation of cultivation symbols and hardiness ratings see page 17).

Mimetes arboreus



Common names: Kogelberg Pagoda, Kogelbergvaalstompie (A)

Height: 2–6 m Spread: 2–4 m

Flowering time: April to June

This beautiful large shrub or small tree is endemic to the cool upper south slopes of the Kogelberg Mountains and is endangered there due to too frequent fires, invasive alien plants and susceptibility to the root fungus *Phytophthora cinnamomi*.

Below: *Mimetes arboreus*

Opposite: *Mimetes capitulatus*



Robbie Thomas

Developing a massive trunk with a thick bark, it has a much-branched, tree-like habit with ascending, overlapping lanceolate leaves and flower heads flushed with coral pink. It can be confused with *M. argenteus*, but the latter forms a much smaller, less branched shrub with shorter, spreading, broadly elliptic leaves. *M. arboreus* is a slow-growing, long-lived plant. It requires an acid, well drained medium derived from sandstone that is kept cool by mulching with well decomposed pine needles, and a cool, well ventilated environment. It is best suited to large rock gardens where no soil disturbance occurs, and to large, deep containers.

Propagation is by cuttings and grafting.

Mimetes argenteus



Common names: Silver Pagoda, Vaalstompie (A)

Height: 1–3.5 m. Spread: 0.5–2 m.

Flowering time: March to June

An erect, sparsely branched shrub from wet peat seeps on sandstone slopes high up in the Hottentots Holland and Franschhoek Mountains east to Riviersonderend in the southern Cape, this plant is endangered in the wild due mainly to groundwater extraction and alien plant invasion.

The shrubs have orangy-pink flower heads and the glowing silvery leaves are clothed in short silky hairs and held at right angles to the stems. The plants are slow-growing but long-lived in the right position, requiring well-drained acid soils derived from Table Mountain Sandstone, and full sun. The soil surface has to be kept cool in summer by mulching with acidic decomposed organic matter like pine needles. Light pruning of the branches after flowering

prevents the plants from becoming too lanky. It is well suited to rock garden pockets and can also be grown in deep containers. See photograph on page 134.

Propagation is by cuttings and grafting.

Mimetes capitulatus



Common names: Conical Pagoda, Skraalstompie (A)

Height: 1–2 m. Spread: 1–1.5 m.

Flowering time: June to December

An erect, small shrub occurring on perennially moist south-facing upper slopes from the Kogelberg to the Klein River Mountains near Hermanus in the southern Cape. It is endangered due mainly to expanding forestry plantations..

The striking red, yellow and white, long-lasting flowerheads resemble those of *Mimetes hirtus*



and have densely hairy leaves which are suberect or tightly clasp the stems, depending on habitat provenance. Like most mimetes, *M. capitulatus* is susceptible to infection by the root fungus *Phytophthora cinnamomi* and requires grafting onto *Leucospermum* rootstock in order to survive in cultivation for any length of time. It requires a moist, acid, well drained, sandstone-derived growing medium and a cool, well ventilated environment. The branches need tip-pruning after directly after flowering to encourage new shoots.

Propagation is by cuttings and grafting.

Mimetes chrysanthus



Common names: Golden Pagoda, Gouestompie (A)

Height: 1.5–2 m, Spread: 0.8–1 m

Flowering time: March to July, with a peak in April

This very showy erect, sparsely branched shrub is confined to steep sandstone slopes of the Gamka and Outeniqua Mountains in the southern Cape, where its numbers are potentially threatened by too-frequent fires.

Mimetes chrysanthus is one of the best species for cultivation, provided it has a warm sunny position and a well-drained, acid soil. Although it occurs naturally in fairly dry habitat, it adapts well to heavier granitic clays and high winter rainfall, such as at Kirstenbosch, and is waterwise once fully established. Its dense yellow flower heads are sweetly scented, make good cut flowers and are highly attractive to many insects, including honeybees and butterflies, and are also visited by sunbirds (see "Attracting wildlife to the garden" on page 27). It responds well to light pruning after flowering and is highly recommended for rock garden pockets or mixed fynbos gardens and can even be grown in large, deep containers.

Propagation is best from cuttings.



Mimetes cucullatus



Common names: Common Pagoda, Rooistompie (A)

Height: 0.5–2 m Spread: 1–2 m

Flowering time: All year round, with a peak from July to November

A colourful and neat, compact shrub with a wide distribution on sandstone flats and lower mountain and hill slopes of the south-western and southern Cape, from the Koue Bokkeveld to the Outeniqua and Kouga Mountains.

This is the easiest *Mimetes* to grow and its many erect stems are produced from a substantial subterranean rootstock or

lignotuber which re-sprouts after fire. The striking red and yellow flower heads have prominent creamy white, silky stamens and there is also a rare greenish yellow form. The flower heads of the cultivar 'Hot Rod' have especially bright red floral bracts. The plants require well-drained, acid, sandy soil in full sun and regular deep irrigation from autumn to late spring. They are waterwise once fully established but appreciate a mulch of well-decomposed pine needles in summer. They readily adapt to granitic soils, are long-lived in the right position and recommended for windy seaside gardens and mixed fynbos beds, and can also be grown in deep containers. The plants respond strongly to hard pruning after flowering. The flower heads are highly prized by nectar-feeding birds such as Southern Double-collared Sunbirds and Sugarbirds.

Propagation is best from cuttings.

Below left: *Mimetes cucullatus* 'Hot Rod'

Below right: *Mimetes cucullatus* (greenish yellow form)

Opposite: *Mimetes chrysanthus*



Robbie Thomas

Mimetes fimbriifolius



Common names: Tree Pagoda, Maanhaar Stompie (A)

Height: 2–4 m. Spread: 2–5 m.

Flowering time: August to November

This very long-lived, large rounded shrub or small tree is endemic to moist sandstone flats and lower slopes of the southern Cape Peninsula.

Its stocky trunk is covered with a thick, corky bark and the hair-fringed leaves produced at the tops of the cylindrical flower heads are an attractive reddish-yellow when the plants are in flower from early spring to early summer. The plants are slow-growing but easy to cultivate, and require plenty of moisture in winter, an acid, well-drained soil in full sun and a mulch of pine needles in summer to keep the soil cool. This is a striking mimetes

for large, windy seaside gardens, grown as a specimen feature, or planted as an informal hedge or windbreak.

Propagation is best from cuttings.

Mimetes hirtus



Common names: Marsh Pagoda, Vleistompie (A)

Height: 1–2.5 m. Spread: 0.5–1 m.

Flowering time: April to September

A handsome, erect shrub from marshes, stream banks and seepage areas of the southern Cape Peninsula, *M. hirtus* extends eastwards from the Kogelberg to west of Bredasdorp in the southern Cape. In the wild it is vulnerable to urbanisation, agriculture and invasive alien plants.

The leaves, like the rest of the plant, are covered with minute hairs, hence the specific name *hirtus*. The flower heads are very prominent, each of which is topped with an erect or flattened comb of reduced green



or pink leaves. The floral bracts are yellow with red tips and it is a species that is much sought-after as a cut flower. It is suited to moist conditions in acid soils and is best planted along natural drainage lines where extra run-off water accumulates (Anthony Hitchcock, pers. comm.). This mimetes readily adapts to granitic media and is recommended for small fynbos gardens, especially when inter-planted with companion fynbos species like *Elegia tectorum*, *Erica perspicua* and *Serruria fucifolia*. Unfortunately it is very susceptible to *Phytophthora* but can be grown in deep containers in sterilized media. It is highly prized by nectar-feeding birds.

Propagation is best from cuttings.

Mimetes hottentoticus



Common names: Matchstick Pagoda, Vuurhoutiestompie (A)

Height: 1–3 m. Spread: 0.5–1m.

Flowering time: January to May, with a peak in February

Perhaps the most striking of all the mimetes, this sparsely-branched shrub is restricted to the highest south-facing slopes of the Kogelberg Mountains.

Even in its natural habitat it is short-lived and it is regarded as critically endangered there due to too frequent fires and its susceptibility to the root fungus *Phytophthora cinnamomi*.

The broad, luminescent silvery leaves contrast superbly against the bright red styles and black pollen presenters. This is a slow-growing plant which is cultivated with difficulty; because its roots are highly sensitive to several fungi, it can only be grown by grafting onto the rootstock of *Leucospermum conocarpodendron*. It requires an acid, well drained sandy soil, free air circulation and a cool environment. It is best grown in deep containers with light overhead shade or in rock garden pockets where no soil disturbance occurs.

Propagation is by cuttings and grafting. Due to its short-lived nature, scion and cutting material should be harvested regularly.

See photograph on page 142.

Below: *Mimetes hirtus*

Opposite: *Mimetes fimbriifolius*, Silvermine Nature Reserve.





Robbie Thomas

Mimetes splendidus



Common names: Splendid Pagoda, Pragstompie (A)

Height: 1.5–3 m. Spread: 1–2 m.

Flowering time: May to September, with a peak from May to July

The distribution of this medium-sized shrub extends from the Langeberg to the Tsitsikamma Mountains of the southern Cape where it is encountered on cool, moist, south-facing slopes. It is endangered in its natural habitat due to alien plant invasion and expanding forest plantations, amongst other causes.

Below: *Mimetes splendidus*

Opposite: *Mimetes hottentoticus*



Mimetes splendidus is indeed splendid, with its bold heads of red, light orange and yellow, atop silver-leaved stems, but it is a plant for the specialist grower. It performs fairly well in cultivation when grafted onto *Leucospermum conocephalum* rootstock and needs an acid, sandy medium in a well ventilated, sunny position.

At Kirstenbosch it has adapted fairly easily to granitic soil in garden beds, and it can be grown in deep containers.

Propagation is by grafting.

Mimetes stokoei



Common name: Mace Pagoda

Height: 1–2 m. Spread: 0.5 m.

Flowering time: April to June

This exquisite silver-leaved, tall and unbranched shrub is endemic to high south-facing moist slopes of the Kleinmond Mountains within the Kogelberg Biosphere Reserve. It is regarded as critically endangered due to too frequent fires and its extreme susceptibility to the root fungus *Phytophthora cinnamomi*.

Its flower heads are not unlike those of *M. hottentoticus*, from which it differs in the ovoid, pinkish subtending leaves of the flower head with bright yellow styles and white perianth segments. In the wild it is a fast-growing plant but has a short lifespan of perhaps 10 years, at times surviving inter-fire periods entirely in the form of subterranean seeds which germinate in response to intense fires (see history on page 6). Like other silver-leaved mimetes, this is a plant for the specialist grower. It performs fairly well when grafted onto *Leucospermum conocephalum* and grown



in very well drained media in full sun, with its roots kept cool by mulching, and excellent ventilation. It has been successfully cultivated by Robbie Thomas in a sandy, acid medium in deep containers, and at Kirstenbosch it has adapted fairly well to granitic soil in open ground.

Propagation is by grafting.



Right: *Mimetes fimbriifolius*

Below: *Mimetes hirtus* interplanted with *Serruria fucifolia*.

Opposite: *Mimetes stokoei*





Serruria (Spiderhead bushes)

Endemic to the western, south-western and southern parts of the Western Cape, the genus *Serruria* has 56 species of mainly prostrate or low bushy shrublets, although a few, including the Blushing Bride *S. florida*, has an erect, lanky growth form (Rebelo 2001). *Serrurias* all have feathery, strongly dissected leaves and actinomorphic flower heads, and many have prominent colourful floral bracts. The flower heads are pollinated by insects, including honeybees. A number of species including *S. cyanoides* and *S. furcellata* survive wildfires by means of a re-sprouting subterranean rootstock, but most spiderheads are killed by fire and regenerate from small nut-like seeds which are sparsely covered with hair. The seeds are carried underground by fynbos ants which consume an oil-rich appendage, the elaisosome, thus escaping predation from rodents and birds. The seeds then germinate once favourable conditions prevail (Bond *et al.* 1991). Many *Serruria* species are highly threatened in the wild (Rebelo *et al.* 2006, see <http://redlist.sanbi.org>).

Cultivation

A number of spiderheads make outstanding garden and container subjects although it has to be borne in mind that they are naturally rather short-lived in cultivation and have to be re-propagated from seed or cuttings after about five to eight years. They like well drained, acid soils containing some well-rotted organic matter but no additional nutrients, as the roots are highly sensitive to chemicals and soil fertilizers. A full sun position with excellent ventilation is required and the plants are suited to rock garden pockets, placed towards the front of mixed fynbos beds and planted in deep containers. The low-growing spiderheads can be grown as edging plants to taller fynbos species or inter-planted with the restio *Thamnochortus cinereus*, the groundcover *Syncarpha argyropsis* and *Erica baueri* subsp. *gouriquae* (Nurriish 2010). After flowering it is essential to pinch out the growth tips to encourage bushiness. *Serrurias* attract many beneficial insects to the garden, including honeybees, beetles and butterflies.

Although some species occur close to the sea, they cannot tolerate sea spray. Once established, the bushes are remarkably waterwise.

Propagation

Spiderheads are propagated from seed or from cuttings, but cuttings have a higher success rate. Seeds are collected as they are released from the seed heads, as premature removal results in failure to germinate (Hitchcock & Adams 2002). Seeds are sown from late summer to late autumn in seed trays placed in a sunny position, in a well drained medium such as 8 parts finely milled pine bark and 3 parts coarse sand. To obtain the optimum pH of 4.5–5.5, lime should be added to very acid media. Cover the seeds with a light layer of sand or milled bark. They should be given a smoke treatment (see page 33) and dusted with a systemic fungicide containing the active ingredient metalaxyl. Germination occurs within three to four weeks and as soon as two true leaves have formed, seedlings can be pricked out into small nursery bags and placed in a lightly shaded, well ventilated area. After one year's growth, or once plants are 50–100 mm high, they can be planted out into the garden or into permanent containers (Nurriish 2010). *S. florida*

Opposite: *Serruria aemula*

is a quick grower from seed, flowering in 15 months, however seed is difficult to germinate and propagation from cuttings is more successful (Adams & McQuillan 2007).

Tip or heel cuttings are taken from midsummer to early autumn (December to March). They should be taken from current growth, measure 30–70 mm long and be dipped into a rooting hormone solution or hormone powder, then placed in a medium of 50% polystyrene pellets and 50% finely milled bark, and placed in a mist unit with 25°C bottom heat and intermittent mist. Once strong roots have developed, remove the cutting trays from the mist unit and harden-off for three weeks, then plant the cuttings into small nursery bags and grow-on until large enough to plant out. Cuttings are generally easy to root, but a major difficulty exists with *S. villosa* in its transplantation into nursery bags, resulting in heavy losses (Nurriish 2012).

Pests and diseases

Serrurias have no major insect pests but the seeds are highly susceptible to pre- and post-emergence damping-off fungi and need dusting with a systemic fungicide prior to sowing. The plants are susceptible to *Phytophthora* to varying degrees (see page 66), for example *S. florida* is highly susceptible whereas *S. fucifolia* is relatively resistant.



Monique McQuillan

Below left: *Serruria aemula*

Below right: *Serruria cyanoides*



Alice Notter

Recommended *Serruria* species

(For an explanation of cultivation symbols and hardiness ratings see page 17).

Serruria aemula



Common name: Strawberry Spiderhead

Height: 0.2–0.5 m Spread: 0.5–1 m

Flowering time: July to October

This low-growing, spreading shrub once occurred in large numbers in deep sandy soils on the Cape Flats from the Cape Town suburb of Rondebosch, east to Firgrove. A few populations still exist along road verges and under powerlines near Milnerton, north of Cape Town, but the species has a high risk of extinction due mainly to habitat loss from urbanisation and to smothering invasive alien plants, amongst other causes.

In the wild, these attractive small shrubs tend to have a straggly habit, but with careful pruning in cultivation, they are transformed into wonderful garden subjects, becoming covered with creamy pink, sweetly scented flower heads from late winter to late spring. *S. aemula* includes a number of distinct growth forms. One from Faure on the Cape Flats, previously known as *S. aemula* var. *congesta*, is critically endangered in the wild, but probably the best one for cultivation, having denser flower heads than the typical form. It is relatively long-lived in ideal conditions and an outstanding subject for sunny rock garden pockets, readily hugging the rocks and cascading over the sides. It easily adapts to well-drained granitic media and is seen to advantage when inter-planted with complementary fynbos species like *Agathosma ovata* 'Kluitjieskraal' and *Podalyria sericea*, and can also be grown in deep containers. The

flowers attract many insects including monkey beetles, honeybees and butterflies.

Propagation is from seed and cuttings.

Serruria cyanoides



Common name: Wynberg Spiderhead

Height: 0.2–0.4 m Spread: 0.5–1 m

Flowering time: July to November

Serruria cyanoides is a small, densely branched shrublet with a persistent rootstock and was once common in deep sandy soils of the Cape Flats east of Cape Town, but is extinct there now. It is currently endangered and confined to isolated populations in acid sands in coastal mountainous parts of the southern Cape Peninsula.

It has typically dissected, smooth leaves and the branch tips produce solitary sweet-scented, pink flower heads. The plants are suited to planting between rocks in sunny rock gardens in well drained, acid sandy soil and also perform well in deep containers. They require regular pruning to encourage new growth from the rootstock, otherwise the branches become long and leggy. Alternatively, established plants can be burnt in late summer to stimulate emergence of new shoots.

Propagation is from seed and cuttings.

Serruria elongata



Common name: Long-stalk Spiderhead

Height: 0.3–0.5 m Spread: 0.5–1 m

Flowering time: July to October



Above: *Serruria florida*

Below: *Serruria elongata*

Below: *Serruria fucifolia*



This variable species forms an erect, small shrub and has a fairly wide distribution in mountainous habitat in sandstone fynbos of the south-western Cape, stretching from the Du Toits Kloof Mountains to Cape Agulhas.

The plant has a lush appearance with erect branches covered with short, heavily dissected leaves. Solitary pinkish buff to purplish brown, fragrant flower heads are borne on short peduncles from an elongate, reddish, common peduncle produced from the apex of each long shoot. This species makes a decorative rock garden subject in well-drained, acid sandy soil.

It is rather short-lived in cultivation, thus constant re-propagation from seed or cuttings is necessary.

Serruria florida



Common names: Blushing Bride, Trots van Franschhoek (A)

Height: 0.8–2 m Spread: 0.5 m

Flowering time: May to October

Certainly the most beautiful of all the spiderheads, this erect, sparsely-branched shrub is native to a single location on granitic slopes within the Franschhoek Mountains of the south-western Cape. It is critically endangered there, due mainly to expanding forestry plantations, alien invasive plants and too-frequent fires.

In the wild, the growth form is tall and lanky, with clusters of flower heads at the apex of each shoot. The floral bracts of individual florets are large and showy, lightly flushed with pink, and surround the central light pink flower cluster. Despite its rarity in nature, the Blushing Bride, thanks to cultivation, is well known and valued as a species for fynbos

gardens. It requires acid, nutrient-poor, well-drained soil in full sun. It requires regular light pruning after flowering to maintain a compact shape. Unfortunately it is short-lived in cultivation, lasting about 5–8 years, and has to be re-propagated at regular intervals. Its economic potential is high, and it is an outstanding cut and dried flower.

Propagation is from seed or cuttings.

Serruria fucifolia



Common names: Northern Spiderhead, Sandveldspinnekopbos (A)

Height: 0.8–1.5 m Spread: 0.5–1 m

Flowering time: April to October

This rounded, robust small shrub is native to sandy flats and lower hill slopes of the West Coast and the interior mountains from the Gifberg south of Vanrhynsdorp to Hopefield. It is endangered due mainly to agricultural expansion.

A robust, much-branched species, *S. fucifolia* has dense, bright green leaves and clusters of silvery pink or purplish grey, sweet-scented flower heads. It has a neat, bushy habit and does not require regular pruning, being one of the easier spiderheads to grow-on the longer term. It has a very long flowering period of at least three months in the garden, remaining attractive even when not in flower. It is recommended for gardens of all sizes and at Kirstenbosch it performs extremely well in mixed fynbos beds in granitic soil, and is also suited to rock garden pockets. It is waterwise once fully established, and prefers a dry summer with a thick mulch. This species is not as susceptible to the root fungus *Phytophthora* as most other spiderheads are.

Propagation is from cuttings or seed.

Serruria furcellata



Common name: Kraaifontein Spiderhead

Height: 0.3–0.5 m Spread: 0.5–1 m

Flowering time: August to October

A small, erect shrub with a persistent rootstock that regenerates after fire, this spring-flowering spiderhead is native to the Cape Flats east of Cape Town. It is critically endangered as only one plant remains in the wild; its habitat has been decimated by smothering alien invasive plants, and urban and industrial expansion, amongst other threats.

The Kraaifontein Spiderhead produces solitary, sweet-scented, pink flower heads at the tips of erect branches which are covered with prominent bright green, smooth dissected leaves. The flower heads resemble those of *S. cyanoides* but differ in being swollen below. Like most spiderheads, this species is



suited to sunny rock garden pockets in well-drained, acid sandy soil and is best planted in association with other low-growing fynbos plants like the buchu *Acmaena obtusata* that will not encroach upon the plants. In the wild it is subject to hot, dry and windy summers and should prove to be waterwise once fully established. It benefits from a mulch of well-decomposed acid material like pine needles to keep weeds at bay and maintain cool soil in summer. The plant requires regular pruning to encourage new growth from its rootstock otherwise the branches become leggy.

Propagation is from seed or cuttings.

Serruria rosea



Common names: Rose Spiderhead, Strooimeisie (A)

Height: 0.5–1.5 m Spread: 0.3–0.5 m

Flowering time: July to October

This spectacular species is perhaps the next most attractive member of the genus after *Serruria florida*. Its natural habitat is acid sands on mountain slopes from Du Toits Kloof to the Riviersonderend Mountains in the southern Cape. Potential threats may arise from forestry expansion and invasive alien species, and it has a conservation status of Near Threatened.

Serruria rosea is an outstanding garden plant and one that can be relied upon to perform well for at least five years in the garden, under ideal conditions. It likes an acid, sandy soil in full sun but easily adapts to granitic media. The plants can reach 1.5 m in the wild but remain compact and neat in cultivation if pruned annually after flowering. It can also be successfully grown in deep containers.

Propagation is best from seed.

Serruria villosa



Common name: Golden Spiderhead

Height: 0.3–0.5 m Spread: 0.3 m

Flowering time: Mainly April to July, sometimes to December

This erect, neat rounded shrublet is endemic to the extreme southern parts of the Cape Peninsula. It is regarded as rare because it has a limited range confined to a particular habitat, but is fully protected within the Table Mountain National Park.

The uppermost leaves are arranged in a distinct whorl beneath each flower head, creating a halo effect. Unusually, the flower heads are yellow and heavily sweet-scented, and the perianth segments are clothed in thin,

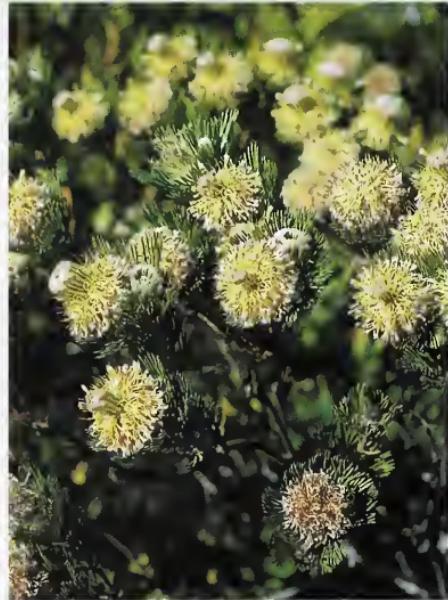
silky hairs, hence the specific name. This is a most attractive species, recommended for sunny rock garden pockets in well-drained acid sand, and it can also be grown successfully in deep containers. It is a wind resistant, waterwise plant once fully established but needs to be re-propagated every few years as it is rather short-lived in cultivation.

Propagation is from seed or cuttings.

Below: *Serruria rosea*

Opposite: *Serruria furcellata*

Below : *Serruria villosa*







Minor Genera

Aulax (Featherbushes)

A small genus of three yellow-flowered species, *Aulax* is endemic to the south-western and southern Cape (Rourke 1987). The stems of these medium-sized shrubs turn reddish with age and are clothed with needle-like, linear or narrowly spoon-shaped leaves. Like *Leucadendron*, *Aulax* species are dioecious and bear male and female flowers on separate plants. The male flower heads are borne in feathery racemes and those of the female are rounded and woody, with the flowers enclosed by an outer involucre of congested sterile branchlets which become brightly coloured at flowering. Insects, including monkey beetles, pollinate the flowers of this genus. *A. pallasia* survives fires by means of a subterranean lignotuber but *A. cancellata* and *A. umbellata* plants are killed by fire and regenerate from rounded, nut-like seeds.

Cultivation

Aulax umbellata is the most rewarding species to grow. Its unusual luminous yellow flower heads and bright green, narrowly spoon-shaped leaves provide excellent contrast and both male and female plants are highly recommended for mixed fynbos gardens and rock garden pockets. They can also be grown

in deep containers provided they are pruned after flowering to encourage bushy new growth and avoid lanky stems. Although this species occurs naturally in sandstone-derived soils, it adapts well to granitic media, provided drainage is good.

Propagation

Aulax species are best propagated from seed sown in autumn, but seem to require a long period of storage to break dormancy before

Above: *Aulax umbellata* (female)

Opposite: *Aulax umbellata* (male)

germination occurs, and propagation is most successful from two-year-old seed. Dust seeds with a systemic fungicide containing the active ingredient metalaxyl and sow in trays or open beds from early to late autumn in a light, well-drained sandy medium such as 8 parts finely milled pine bark and 3 parts coarse sand. To obtain the optimum pH of 4.5–5.5, add lime to very acid media. Cover the seeds with a 1 cm layer of sand and treat with smoke (see page 33). Germination occurs within three to four weeks and seedlings take three to four years to flower (Jamieson 2001).

Pests and diseases

Aulax species are not subject to any serious pests but the roots are susceptible to *Phytophthora* (see page 66).

Recommended *Aulax* species

(For an explanation of cultivation symbols and the hardiness rating see page 17).

Aulax umbellata



Common names: Broad-leaf Featherbrush, Veerkanariebos (A)

Height: 1–2.5 m Spread: 0.5–1 m

Flowering time: November to February

A slender, erect shrub occurring on lower sandstone mountain slopes and coastal sandy flats from the Kogelberg to Stilbaai in the southern Cape.

The male flower heads are borne in an open terminal raceme whereas those of female plants have congested rounded heads.

Opposite: *Aulax umbellata* (female)

Below: New foliage of *Aulax umbellata* (female).







Above: The sweet-scented racemes of *Brabejum stellatifolium*.

Below: Ripe fruits of *Brabejum stellatifolium*.

Opposite: The coppery new leaves of *Brabejum stellatifolium*.



Brabejum

Brabejum stellatifolium is the sole member of this genus and widely distributed from the Gifberg, south of Vanrhynsdorp, to the Cape Peninsula and east to Riversdale in the southern Cape (Rebelo 2001). It forms a large and extremely long-lived, sprawling, often multi-stemmed tree with a thick, smooth bark and occurs in dense stands alongside rivers on sandstone mountain slopes. The minute cream-coloured flowers are arranged in whorls on dense racemes and their sweet scent attracts insect pollinators including honeybees. The leaves have strongly toothed edges and are usually borne in six-leaved clusters. The almond-sized fruits have a velvety golden-brown exterior of very short hairs and are dispersed by water during autumn and winter floods. In the wild the trees are killed by fire but re-sprout from a persistent rootstock.

Cultivation

The giant sprawling habit of the Wild Almond makes it suitable for only the largest of gardens and parks. It is moderately fast-growing and performs well in moist, well-composted sandstone or granitic soils in full sun or semi-shade. It is ideal for screening unsightly buildings and the branches respond strongly to pruning, thus specimens can easily be trained into hedges. (For an explanation of cultivation symbols and the hardiness rating see page 17).

Propagation

Brabejum stellatifolium is most successfully propagated by seed sown from late summer to late autumn and the fruits can be sown as is, without the need to extract the seed; they germinate immediately and cannot be stored. The ripe fruits are placed on top of a well-drained, acid, seed-sowing medium consisting of equal parts of sand and well decomposed compost, or can be pressed halfway in or until lightly covered. When 10 cm tall, seedlings can be potted-up or planted out into permanent positions in the garden (Notten & Malan 2003).

Pests and diseases

This species has no serious diseases but the leaves and stems are sometimes subject to blister-like leaf galls caused by gall wasps (see page 61). The problem is usually not serious

enough to warrant intervention but in severe instances spraying with cypermethrin may be necessary.

Brabejum stellatifolium



Common names: Wild Almond, Wilde-amandel (A), Ghoeboontjie (A)

Height: 5–8 m Spread: 5–15 m

Flowering time: December to January





Left: *Diastella divaricata* subsp. *divaricata*

Below: *Diastella divaricata* subsp. *montana*



Diastella (Silkypuffs)

A small genus of seven dwarf species, *Diastella* is closely related to *Leucospermum* and is endemic to acid sandy flats and mountain slopes of the south-western Cape (Rourke 1976a). It consists of low-growing, rounded or mat-forming shrublets with small cushion-like pink or white silky flower heads that resemble powder puffs. The plants have small elliptic, linear, needle-like or oval leaves which are smooth or hairy. The flowers are pollinated mainly by bees and, like those of *Leucospermum*, *Diastella* produces smooth, nut-like seeds which have an elaiosome (an oil-filled appendage which is consumed by fynbos ants in underground nests). In habitat the plants are killed by fire but regenerate from seed. Most *Diastella* species are threatened in the wild (Rebelo et al. 2006, see <http://redlist.sanbi.org>).

Cultivation

Diastellas flower for most of the year and make interesting subjects for 20–25 cm-diameter plastic or terracotta pots, as edging plants, subjects for rock garden pockets, as groundcovers or allowed to sprawl over low retaining walls. The plants require full sun and well-drained, acid soils such as equal parts of coarse grit and well-rotted acid compost. Light pruning after flowering is necessary to maintain compact, neat growth.

Propagation

Plants of this genus are usually propagated from cuttings as seed collection is difficult and time-consuming. Tip or heel cuttings 30–70 mm long from the current season's growth are taken in spring or autumn and treated with a rooting hormone used to encourage rooting in semi-hardwood cuttings. They are inserted into multitrays and placed on heated benches (25°C) under intermittent mist. A suitable rooting medium is equal parts of finely milled pine bark and polystyrene pellets. Rooted cuttings are transferred to small nursery bags in a sandy, well-drained acid medium. Feeding with a seaweed-based fertiliser is recommended. If plants are propagated from seed, sow them in late summer or early autumn and dust them with a systemic fungicide containing the active ingredient metalaxyl to control pre- and post-emergence

damping-off fungi (Hitchcock 2002a).

Applying a smoke treatment (see page 33) improves germination.

Pests and diseases

Diastella species are not subject to any serious insect pests but seedlings are highly susceptible to pre- and post-emergence damping-off fungi (see above). The species recommended below are fairly resistant to *Phytophthora*.

Recommended *Diastella* species

(For an explanation of cultivation symbols and hardiness ratings see page 17).

Diastella divaricata subsp. *divaricata*



Common name: Peninsula Silkypuff

Height: 0.3–0.5 m Spread: 1.5–3 m

Flowering time: January to December, with a peak from August to September

Forming a low, sprawling shrublet, it is confined to acid sandy flats near the coast in mountains of the southern Cape Peninsula, and is considered rare, but is protected within the Table Mountain National Park.

Each flowering branch is covered with erect, hairy oval leaves and produces a very small, solitary, pink, silky flower head at its tip. This plant is recommended for containers as the pinkish red branches naturally tend to cascade over the sides.

Diastella divaricata subsp. *montana*



Common name: Mountain Silkpuff

Height: 0.3–0.5 m Spread: 2–3 m

Flowering time: January to December, with a peak from August to September

This low-growing subspecies is confined to south-facing mountain slopes from Villiersdorp to the Kleinrivier Mountains near Hermanus and differs from subsp. *divaricata* in producing multiple pink flower heads at the branch tips and in its longer leaves.

Like subsp. *divaricata*, this plant is recommended for containers, the pinkish red branches readily cascading over the sides.

Diastella parilis



Common name: Worcester Silkpuff

Height: 0.15–0.7m Spread: 0.3m

Flowering time: May to January

This mat-forming or sprawling, rounded shrublet is confined to the Elandskloof and Slanghoek Mountains around Tulbagh in the Upper Breede River Valley and is critically endangered as a result of habitat loss from grapevine farming and alien plant invasion, amongst other threats.

The flower heads are similar to those of *D. divaricata* but larger and differ in having unequal perianth lobes. This is a species best suited to cultivation in containers. In the Collections Nursery at Kirstenbosch it has been grown successfully in a 25 cm-diameter shallow terracotta pot.

Below: *Diastella parilis*



Faurea (Beechwoods)

A robust genus of about 15 species, *Faurea* comprises long-lived shrubs or small to large trees and is native mainly to subtropical and tropical Africa and Madagascar (Brummitt & Marner 1993). Seven species occur in southern Africa and only *F. macnaughtonii* is represented in the Cape Floristic Region in the southern Cape. The flowers are carried in long pendent spikes and are pollinated by honeybees. The wood of certain species is famous for its beautiful grain in furniture-making and that of *F. saligna* is resistant to termites and wood borers, and excellent material for poles. The seeds are hairy and nut-like.

Cultivation

Southern African *Faurea* species are rarely cultivated as they are slow-growing and generally difficult to propagate. However they make interesting and attractive specimen trees with their colourful autumn foliage and the nectar-filled flowers are highly attractive to birds, bees and other insects. The trees like full sun and well-drained acid soils containing some organic matter, but no added fertiliser. Like all Proteaceae, the roots are highly sensitive to disturbance.

Propagation

Faurea species are best propagated from seed as cuttings are difficult to root. Seed is sown in spring or early summer and would probably respond well to treatment with smoke or smoke essence (Glen 2008). (See page 33). Seedlings are best planted out into permanent positions as soon as large enough to handle, in order for the tap root to become established at an early stage.

Pests and diseases

Established trees of *F. rochetiana* and *F. saligna* at Kirstenbosch have not shown susceptibility to any serious pests or diseases (including *Phytophthora*) but the leaves are sometimes damaged by caterpillars (see page 60).

Recommended *Faurea* species

(For an explanation of cultivation symbols and hardness ratings see page 17).

Faurea rochetiana (=*F. speciosa*)



Common names: Broad-leaf Boekenhout, Breëblaarboekenhout (A), Mogwapi (NS), Mutango (V)

Height: 4–10m Spread: 3–5m

Flowering time: March to September

This small to large deciduous or evergreen tree occurs from northern KwaZulu-Natal along the escarpment of Swaziland, Mpumalanga and Limpopo northwards to East and West Africa.

Faurea rochetiana has a gnarled, crooked trunk and a spreading crown with dense, pendent, cream or pink spikes. The broad leathery leaves turn red in autumn and this is its main feature. In mild climate areas such as the southern suburbs of Cape Town, this species remains evergreen in winter but in colder parts it is deciduous. With careful shaping it can be grown as a small specimen tree. It is slow-growing but unlike most other Proteaceae is long-lived in ideal conditions and has performed admirably in well drained, granitic soil in garden beds at Kirstenbosch.

Propagation is from seed.



Above: *Faurea rochetiana*

Opposite left: The fruit of *Faurea rochetiana*.

Opposite right top: The reddish new leaves of *Faurea saligna*.

Opposite right bottom: The deeply fissured bark of *Faurea rochetiana*.

Faurea saligna



Common names: African beech, boekenhout (A), umcalathole (Z), muTango (Venda)

Height: 7–20m Spread: 3–6m

Flowering time: August to February

Forming a small to large tree, this species grows in coastal and inland KwaZulu-Natal and extends to Swaziland, Mpumalanga, Gauteng, North-West and Limpopo, and north into tropical Africa.

The narrow, pendent leaves impart an attractive 'willow-like' appearance and the trunk develops a beautiful corky bark with age. These decorative trees are suited to specimen planting in large gardens and are semi-deciduous in cold winter parts of South Africa but remain fully evergreen in areas with mild winters, such as at Kirstenbosch, where it performs well in deep granitic soil. The greenish or white flower spikes have an attractive honey- or coconut-like scent.

Propagation is from seed.





Orothamnus

As rare as it is beautiful, the slender Marsh Rose of almost mythical repute is the sole member of the genus and confined to moist, middle- and upper south-facing mountain slopes of the Kogelberg, Kleinmond and Kleinrivier Mountains in the south-western Cape (Rourke 1982). It is vulnerable in its habitat due mainly to its susceptibility to the root rot fungus *Phytophthora cinnamomi* and inappropriate fire management (Rebelo *et al.* 2006, see <http://redlist.sanbi.org>). The Marsh Rose forms an erect, few-branched shrub. Its stems are clothed in overlapping, oval light green leaves covered with dense, soft white hairs and the individual flowers are held within nodding flower heads, enclosed with large waxy, pinkish red involucral bracts. The flowers are pollinated by generalist insect pollinators but although the plants are killed by fire, the smooth, nut-like seeds remain viable within the soil for many years until favourable conditions for germination occur. The seeds possess an elaiosome which is consumed by fynbos ants in underground nests. This is a species for the specialist grower as it cannot be cultivated successfully on its own roots due to its susceptibility to fungal disease, and requires grafting onto fungus-resistant rootstock.

Cultivation

The plant can only be grown successfully when softwood cuttings are grafted onto suitable rootstock, such as *Leucospermum conocarpodendron*. Cultivation in deep containers appears to be the best way of maintaining this species and at Kirstenbosch plants bloom regularly in 25 cm-diameter plastic pots. It requires a very well-drained, sandy, acid growing medium, a sunny position, excellent ventilation and a natural water supply not treated with chemicals. Careful staking from an early age is necessary to prevent plants from blowing over.

Propagation

Grafting is currently the only successful method of propagating this plant (see page 39). Seed production is poor, even after hand pollination, and germination of viable seeds is a lengthy process, seedlings inevitably failing to survive more than a few months.

Right: *Orothamnus zeyheri* flower head.

Opposite: *Orothamnus zeyheri* in cultivation at Kirstenbosch.

Pests and diseases

In cultivation the plant has few serious pests but it is highly susceptible to *Phytophthora* (see page 66).

Orothamnus zeyheri



Common names: Marsh Rose, Vleiroos (A)

Height: 2–4m Spread: 0.3–0.5m

Flowering time: May to October, with a peak in September





Paranomus (Sceptre bushes)

The genus *Paranomus* comprises 18 species of small, medium-sized or robust shrubs, most of which occur on sandstone mountain slopes of the southern Cape (Rebelo 2001). The foliage of some members is noteworthy in being dimorphic, having finely divided leaves on the lower branches but much larger leaves with more or less entire margins higher up, below the flower heads. Inflorescence type is compound and made up of spikes of flower heads, each with a prominent bract which remains on the plant long after flowering and fruiting has ceased. *Paranomus* flowers are pollinated by bees and monkey beetles and like those of several other genera including *Diasella*, *Leucospermum*, *Orothamnus* and *Serruria*, the smooth, nut-like seeds possess an oil-containing elaiosome which is consumed by fynbos ants in underground nests, where the seeds germinate after wildfires. Certain forms of *P. spathulatus* regenerate after fires from a persistent subterranean rootstock but generally *Paranomus* species are killed by fire and regenerate from seed. Several *Paranomus* species are threatened in the wild (Rebelo *et al.* 2006, see <http://redlist.sanbi.org>).

Cultivation

Very few species are grown and the large-flowered *P. reflexus* is certainly the one most familiar in cultivation. The plants require well drained, acid soils in full sun and are rewarding, interesting plants for the mixed fynbos garden, rock garden or deep container. Although most species occur naturally on sandstone, they easily adapt to granitic soils. Light pruning after flowering is necessary to encourage bushy new growth and the plants are waterwise once fully established. The bushes need replacing from time to time as their lifespan in cultivation is relatively short, lasting 8–15 years in ideal conditions (Notten 2010a).

Propagation

Sow the seeds from late summer to autumn in multitrays in a sterile, well-drained, acid medium such as 8 parts finely milled pine bark and 3 parts coarse sand. To obtain the optimum pH of 4.5–5.5, lime should be added to very acid media. Cover the seeds very lightly with a thin sand layer or finely milled

bark, and keep moist but not waterlogged. Prior to sowing, dust the seeds with a systemic fungicide containing metalaxyl to combat soil-borne fungi. Applying a smoke treatment (see page 33) improves germination. Once the first pair of true leaves has developed, seedlings can be transplanted into nursery bags and grown-on for a year before planting out into garden beds or permanent containers.

Alternatively, semi-hardwood cuttings can be taken in autumn or spring. Cuttings taken from branches with dissected leaves root more successfully than those with non-dissected ones and it is important not to use branches bearing flower buds for cutting material. Strip the leaves from the lower third of the cutting, treat with a semi-hardwood rooting hormone and insert into a rooting medium such as equal parts of finely milled pine bark and polystyrene pellets with bottom heat of 24°C and intermittent mist.

Pests and diseases

The leaves and flower heads have no serious pests but the roots are susceptible to *Phytophthora* (see page 66).

Opposite: *Paranomus reflexus*

Recommended *Paranomus* species

(For an explanation of cultivation symbols and hardiness ratings see page 17).

Paranomus reflexus



Common name: Van Staden's Sceptre

Height: 1–2 m Spread: 0.5–0.8 m

Flowering time: April to August

This neat, ornamental small shrub is found on sandstone slopes in the Van Staden's Mountains, west of Uitenhage in the Eastern Cape, and is endangered there due to expanding forestry plantations and smothering invasive alien weeds.

The plants bear two distinct leaf types, those in the lower parts of the branches are finely dissected, while those in the upper parts are entire with their margins curved upwards. The striking creamy yellow rocket-shaped



flower heads are borne singly at the tips of the branches and the individual flowers are distinctly reflexed. An easily cultivated species, *P. reflexus* is a fast grower and suited to rock garden pockets and mixed fynbos beds.

Propagation is from seed or cuttings.

Paranomus sceptrum-gustavianus



Common names: King Gustav's Sceptre, Septerpluimbos (A)

Height: 1–1.8 m Spread: 0.4–0.5 m

Flowering time: June to March

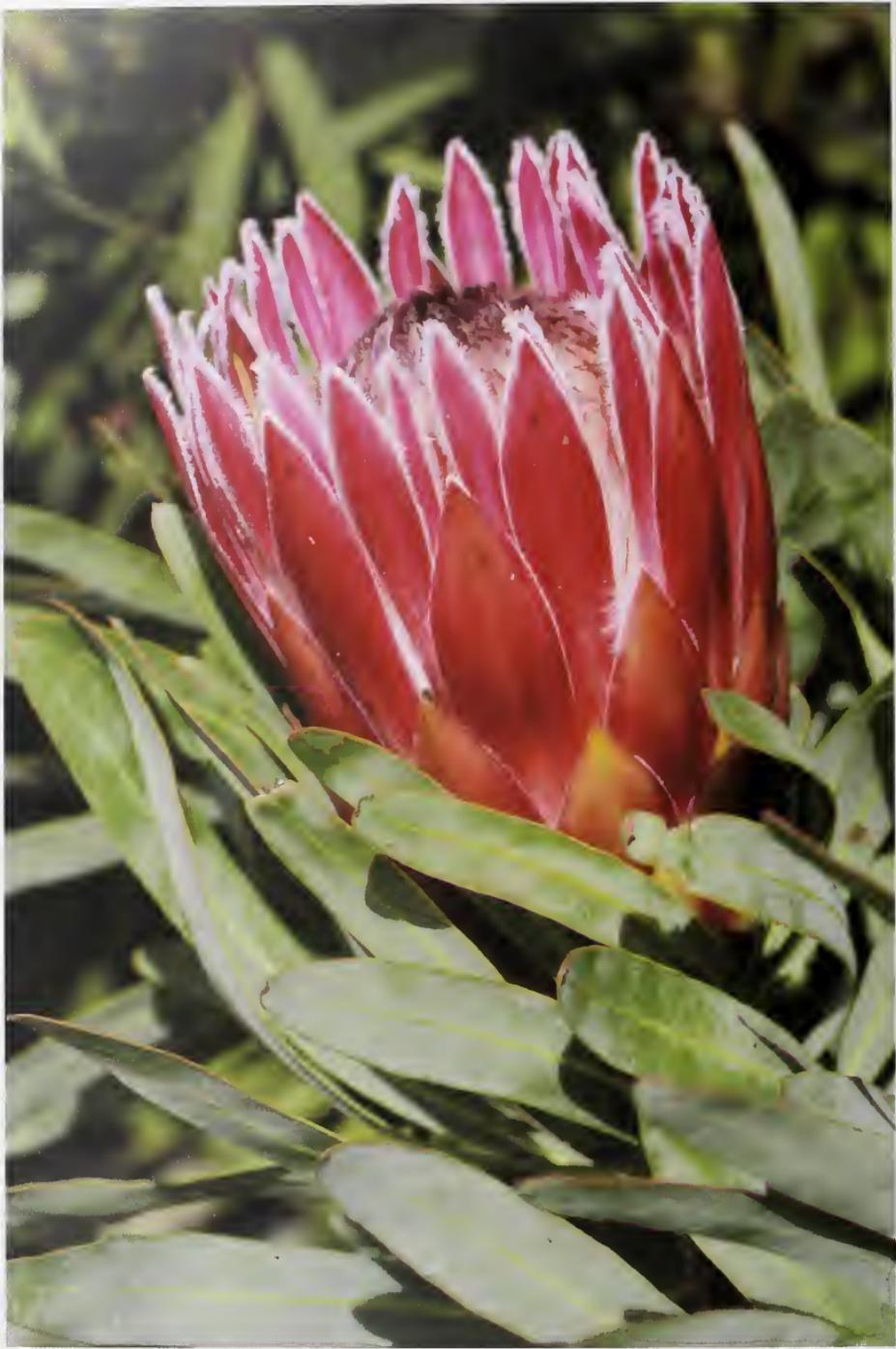
Forming a densely-branched, medium-sized or robust shrub, *P. sceptrum-gustavianus* occurs as scattered individuals on south-facing sandstone slopes from the Hottentots-Holland Mountains east to the Langeberg Mountains near Swellendam.

This beautiful species bears light-cream flower heads atop sturdy, erect branches and the flowers emit an invigorating scent. It has a very long flowering period, blooming at any time from midwinter to early autumn depending on wild origin. It performs very well in deep containers provided regular light pruning is given straight after flowering.

Propagation is from seed or cuttings.

Left and opposite: *Paranomus sceptrum-gustavianus*





Hybrids

Natural hybrids are rare in the South African Proteaceae. Here we describe two horticulturally outstanding *Leucospermum* hybrids from the Cape Peninsula. (For an explanation of cultivation symbols and hardiness ratings see page 17).

Recommended natural hybrids

Leucospermum 'Thomson's Gift'



Parentage: *L. conocephalum* subsp. *viridum* x *L. hypophyllocarpodendron* subsp. *hypophyllocarpodendron*

Height: 0.2–0.3m Spread: 0.5–1m

Flowering time: September to October

Plants of this very rare natural hybrid were found in 1987 amongst its parents on sandstone near Kommetjie in the southern

Cape Peninsula and donated to Kirstenbosch National Botanical Garden by Stuart Thomson, after whom it is named.

The hybrid displays the decumbent spreading habit of *L. hypophyllocarpodendron*, and smaller versions of the flower head and leaf shape of *L. conocephalum*.

'Thomson's Gift' forms a very attractive prostrate groundcover, producing solitary honey-scented, bright yellow flower heads at the tips of the branches. The plants perform very well in rock garden pockets, sprawling over low retaining walls and in deep containers. They adapt easily to granitic soils and need full sun to flower well.

Propagation is from cuttings.

Below: *Leucospermum 'Thomson's Gift'*

Opposite: *Protea 'Liebencherry'*



Leucospermum 'Thomson's Phoenix'



Parentage: *L. conocephalum* subsp. *viridum* x *L. hypophyllocarpodendron* subsp. *hypophyllocarpodendron*

Height: 0.35–0.5 m Spread: 1m

Flowering time: August to September

Leucospermum 'Thomson's Gift' (see page 173) and *Leucospermum 'Thomson's Phoenix'* have the same parents and the latter was found amongst its parents on sandstone near Kommetjie in 2003 and donated to Kirstenbosch by Stuart Thomson.

This hybrid differs substantially from 'Thomson's Gift'. Although it has a spreading growth habit similar to that of *L. hypophyllocarpodendron*, it forms a low shrublet with a thick, stout trunk like that of *L. conocephalum*. Its leaves and flower heads are much larger than those of 'Thomson's Gift'.

It is ideally suited to rock garden pockets and large containers.

Propagation is from cuttings.

Popular artificial hybrids

Artificial hybrids of South African Proteaceae are now widely available in international trade and here we briefly describe some examples. Hybrids are usually more vigorous than wild species and often more frost tolerant. To preserve their genetic traits, they are propagated from cuttings. (For an explanation of cultivation symbols and hardiness ratings see page 17).

Leucadendron 'Jester'



Parentage: *L. salignum* x *L. laureolum*

Height: 1.2–1.5 m Spread: 0.3–0.5 m

Flowering time: April to July



A New Zealand-raised hybrid, this extraordinary plant was introduced in 1990.

It has variegated foliage in shades of pink, cream and green, with pinkish red involucral bracts and red stems, and is a sport of 'Safari Sunset' but is less vigorous with a reduced mature height. It performs well in full sun and is drought tolerant once established. The bright variegated foliage may appear too garish for less adventurous gardeners, yet this is one of the most popular hybrid conebrushes for garden cultivation and its cut stems are sought-after for flower arrangements.

Leucadendron 'Safari Sunset'



Parentage: *L. salignum* x *L. laureolum*

Height: 2–3 m Spread: 1.5–2 m

Flowering time: March to June

This New Zealand-raised hybrid was introduced in 1964.

Forming an erect, bushy shrub, this vigorous, long-lived conebrush bears deep red involucral bracts on long red, straight stems. It is an outstanding garden plant as it adapts to a range of acid or neutral soil types and is very waterwise once established. It can be grown as a specimen feature, in mixed plantings or as an informal hedge, screen or windbreak. Its long stems are excellent 'filler' material for flower arrangements. Young bushes need staking in strong wind and mature plants benefit from annual pruning to encourage bushy new growth.

Below left: *Leucadendron 'Jester'*

Below right: *Leucadendron 'Safari Sunset'*

Opposite: *Leucospermum 'Thomson's Phoenix'*



Leucadendron 'Silvan Red'



Parentage: *L. laureolum* x *L. salignum*

Height: 1.8–2.4 m Spread: 1.5–1.8 m

Flowering time: May to August

This hybrid was raised in Australia in 1982.

It closely resembles 'Safari Sunset' but has a slimmer appearance with tulip-shaped flower heads and narrower, burgundy-coloured leaves. It is a fast-growing and compact, long-lived plant and recommended for landscape beds, screening and as a windbreak. It prefers slightly acid to neutral soils, is waterwise once established and excellent for the vase.

Protea 'Liebencherry'



Parentage: *P. repens* x *P. longifolia*

Height: 1.5–2 m Spread: 1.5–2 m

Flowering time: April to July

Below: *Leucadendron 'Silvan'*



This hybrid was raised and introduced in South Africa in 1993.

It is a very free-flowering, spreading shrub and a long-lived garden plant. Its deep pinkish red involucral bracts with white hairy margins contrast beautifully against the greenish grey foliage. The branches require annual pruning after flowering to encourage new shoots and it is very waterwise once established. It is best suited to mixed plantings in large fynbos gardens, and makes an excellent cut flower.

Protea 'Pinita'



Parentage: *P. magnifica* x *P. longifolia*

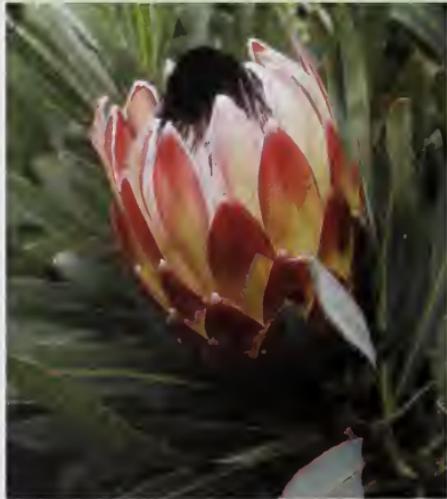
Height: 1–2 m Spread: 2–3 m

Flowering time: May to July

'Pinita' was raised in South Africa and introduced in 1994.

It is a sturdy, spreading shrub whose involucral bracts are pinkish red at the tips and creamy yellow towards the base, with pink florets and a

Below: *Protea 'Pinita'*



pointed black centre. Its long, strong stems are ideal for picking and it is an attractive and long-lived landscape plant. The stems need annual pruning to encourage bushy new growth.

Protea 'Pink Ice'



Parentage: *P. compacta* x *P. susannae*

Height: 1.8–2.4 m Spread: 2–3 m

Flowering time: January to October

'Pink Ice' was raised in Australia and promoted internationally in 1987.

This is a vigorous, medium-sized shrub and one of the most easily cultivated protea hybrids. It is one of few proteas that will tolerate clay soils and is very waterwise once established. The deep pink involucral bracts have an attractive silvery sheen and the flower heads are highly prized as long-lasting cut flowers. In addition, due to its vigour and resistance to disease, 'Pink Ice' is frequently used as rootstock material in grafting.

Below: *Protea 'Pink Ice'*



Robbie Thomas

Serruria 'Pretty 'n Pink'



Parentage: *S. florida* x *S. rosea*

Height: 0.5–1 m Spread: 0.5–1 m

Flowering time: July to August

'Pretty 'n Pink' was raised in Australia.

It is a vigorous plant with strong, erect, long reddish stems. Its darker and denser foliage and denser flower clusters combine the best traits of its parents.

It is recommended for rock garden pockets and deep containers and needs a slightly acid medium. After flowering the stems need judicious pruning to encourage new growth. It is an outstanding cut flower, is waterwise once established and harder than its parents.

Below: *Serruria 'Pretty 'n Pink'*



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Below: *Mimetes cucullatus*



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By joining the Botanical Society of South Africa (BotSoc), one can take advantage of the Kirstenbosch Seed Catalogue of surplus seed supplied by the South African National Biodiversity Institute. A wide selection of Proteaceae species is usually included in this offer. At the Society's Annual Garden Fair at Kirstenbosch, one can purchase a wide selection of protea plants.

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Right: *Protea cynaroides*

Glossary

acid Soils that have a pH level below 7

alkaline Soils that have a pH level above 7

anemochory Dispersal of plant seeds or spores by wind

callus Tissue that develops in response to physical damage and establishes the union between the rootstock and scion

cambium The layer of actively dividing cells between the xylem and phloem tissues

chlorosis Abnormal reduction or loss of green chlorophyll in leaves, resulting in yellowing

cultivar A variation of a species that has been produced through breeding or deliberate selection

dimorphic Existing or occurring in two distinct forms, e.g. leaves of *Paranomus*

dioecious Species in which the male and female reproductive organs occur on different individuals

elaiosome Oil-filled appendage of the seeds of *Leucospermum*, *Mimetes* and other fynbos genera

ex situ Outside the natural habitat, i.e. in a new wild location or a man-made environment

fertigation The application of fertilisers or other water-soluble products through an irrigation system

form With respect to different morphological variants of a species

fynbos Dominant vegetation of the Fynbos Biome, characterised mainly by restios, ericas, buchus, proteas and members of the Asteraceae, Rhamnaceae and Thymelaceae

humus Dark organic matter made up of well-decayed organic materials

hybrid Offspring resulting from crossing two species

inflorescence The arrangement of flowers on a stem or axis

in situ In its original place, i.e. in the wild

involucral bracts The outer whorl or whorls of colourful bracts which surround the flowers

lignotuber A thick underground woody stem containing dormant buds which sprout after fire or when stems are cut back hard

loam A mixture of varying proportions of sand, organic matter and clay

monotypic genus Consisting of a single species

monotypic species Consisting of a single population that is not subdivided into subspecies

myrmecochory Seed dispersal by ants

neutral Soils that have a pH level of 7

petiole The leaf stalk

proteoid roots The fine, dense clusters of hairy rootlets produced by all members of the Proteaceae, enabling the plants to absorb minute amounts of nutrients from the nutrient-poor soil

raceme A simple, elongated inflorescence with stalked flowers

rootstock An established plant onto which a cutting or bud from another plant is grafted

scarification Modification of the seed coat e.g. by soaking or filing, such that moisture can enter to facilitate germination

scion A detached aerial bud or shoot joined to the rootstock of a plant in grafting

serotiny The release of seeds in exclusive response to an environmental trigger, i.e. fire

sport A morphological mutation, differing from the rest of the plant

stratification Cold temperature treatment of seeds to break dormancy and facilitate germination

subglobose Not having the perfect shape of a sphere, i.e. somewhat flattened

subtending Occurring just below or close to

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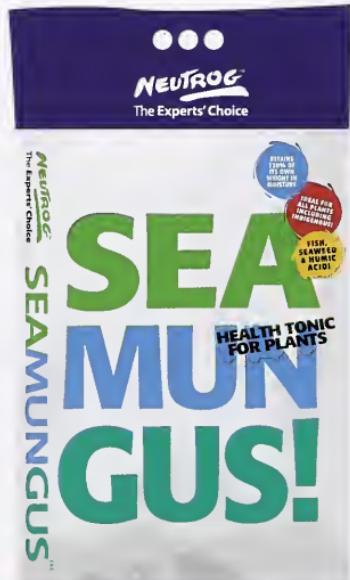
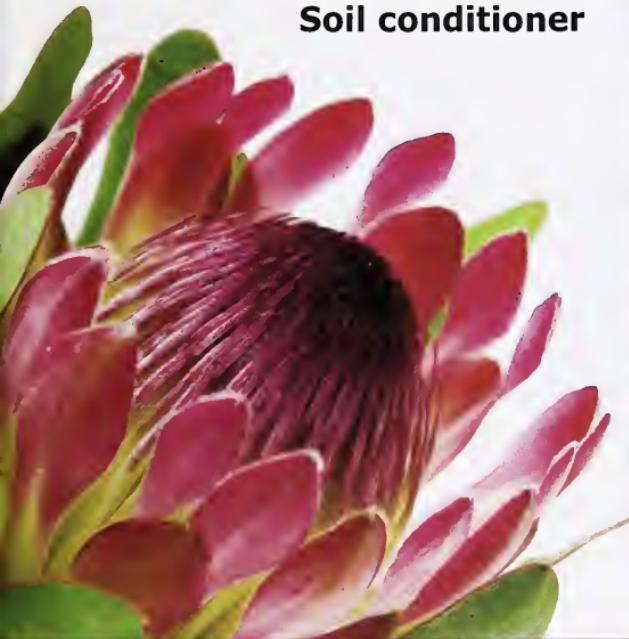
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Graham Duncan is a specialist horticulturist and botanist and has curated the living collection of bulbous plants at Kirstenbosch since 1979. In addition to *Grow Proteas*, he has authored or co-authored six other titles in the Kirstenbosch Gardening Series (*Grow Agapanthus*, *Grow Bulbs*, *Grow Clivias*, *Grow Disas*, *Grow Fynbos Plants* and *Grow Nerines*). His special interest in the genus *Lachenalia* resulted in the publication of a monograph titled *The Genus Lachenalia* (published by Kew in 2012).

Neville Brown retired as specialist scientist at the Kirstenbosch Research Centre in 2005. His special research interest is dormancy and germination of fynbos species with particular reference to the effect of plant-derived smoke on seed germination and obtained his PhD from the University of Natal in 1975 for a thesis entitled *Seed dormancy and germination in Protea compacta and Leucadendron daphnoides*. In 1998 he co-founded the *Kirstenbosch Gardening Series*.



Louise Nurris has always had a passion for growing and propagating indigenous plants and joined the Kirstenbosch horticultural staff as specialist horticulturist responsible for proteas and restios in 2008. Previously she worked for the Millennium Seed Bank where she collected plant seeds from natural populations in order to bank and preserve them for future generations. In this position she was able to do a lot of fieldwork exploring and discovering the beauty of fynbos.

Robbie Thomas began growing Proteaceae and experimenting with seed germination when he retired to Betty's Bay in 2003. He had success germinating seeds of some notoriously difficult species like *Orothamnus zeyheri*, but *Mimetes* seeds proved particularly difficult. Determined to learn more, he contacted the few experts in the field of Proteaceae propagation and began grafting. His skill with grafting and the resultant success rate improved with time.

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Main cover picture: *Protea cynaroides* with a Green Protea Beetle on sandstone flats near Bredasdorp.

Insets, top left to right: *Leucospermum erubescens*, *Serruria florida*, *Leucadendron discolor*, *Mimetes cucullatus*.

Bottom, left to right: *Protea nerifolia*, *Protea coronata*, *Orothamnus zeyheri*, *Mimetes chrysanthus*.

Back cover: *Mimetes stokoei*

Photographs by Graham Duncan

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